EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-10

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2012	
	Base X Option Period Number	

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 09/29/2011 To 03/31/2012

Comments:

[ ] Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): [ ]

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period:	Cost/Fee:	LOE:
04/01/2009 To 03/31/2012		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Worth Calfee (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7600 FAX Number: 919-541-0496
Project Officer Name: Larry Farmer (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3104 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Renita Tyus Renita Tyus (Signature) 9/29/11 (Date)	Branch/Mail Code: CPOD Phone Number: 513-487-2094 FAX Number: 513-487-2109

STATEMENT OF WORK

EVALUATION OF VACUUM-BASED SAMPLING DEVICES FOR COLLECTION OF BIOLOGICAL AGENT

OMIS DCMD 3.60

TABLE OF CONTENTS

I. TITLE

Evaluation of Vacuum-Based Sampling Devices for Collection of Biological Agent.

II. PERIOD OF PERFORMANCE

The period of performance for this Work Assignment (WA) shall be from the date of Award to March 31, 2012.

III. SUMMARY OF OBJECTIVES

The objective of this project is to evaluate currently-available vacuum-based devices for biological sampling efficiency. Performance of devices shall be compared to the currently-preferred method, the "Vacuum Sock" (Midwest Filtration; Cincinnati, OH). The proposed work will generate data that can be used to select appropriate sampling devices following a bioterror event. Scientifically-testing sampling methods will provide increased confidence in the ability to characterize contamination following such an event.

IV. RELEVANCE

The products from this project will be used to guide decisions with regard to the selection and application of candidate vacuum-based sampling technologies and methods for characterization of contamination post bioterror incident. The results of this work will be made available through published reports, journal papers, and/or conference abstracts and presentations.

V. BACKGROUND

Methods for detection and characterization of biological agent on surfaces following a bioterror incident include swabs, wipes, and vacuum. The currently-used vacuum-based method utilizes woven collection socks attached to a cardboard nozzle. The sock and nozzle affix to the most upstream end of the vacuum hose, so that agent is captured by the sampling sock and does not contaminate the equipment. Multiple samples can be collected in progression by affixing a new collection sock to the vacuum hose between samples. Some have demonstrated that this method has utility in collection of biological agent (Brown et al., 2007); however most contend that improvements could be made to the method or another vacuum-based sampling device would be more efficient. Some criticisms of the current method are that the vacuum socks often come from the manufacturer with clearly visible holes in the sock seams, and that the filters are too cumbersome for laboratory handling and extraction during analysis.

VI. SCOPE

Under this SOW, the Environmental Protection Agency (EPA) in collaboration with the Centers for Disease Control and Prevention (CDC) will direct a study to evaluate several vacuum-based sampling devices for collection of biological agent from environmental surfaces. The contractor shall conduct the tests in accordance with a developed and approved quality assurance test plan.

VII. TECHNICAL APPROACH

A study shall be designed and conducted to evaluate vacuum-based biological sampling devices for collection of biological agent from environmental surfaces. Collection from multiple surface types shall be evaluated with each sampling device. These evaluations shall be carried out within the tasks outlined below. Potential test parameters are presented in Table 1. (Details of tests performed will be based on input from the EPA/CDC interagency project team)

A known quantity of *Bacillus* spores will be deposited by aerial dispersion onto large coupons (1 $ft.^2$ or greater) of various materials common to the built environment, which may include unpainted (smooth finish) concrete, upholstery, and carpet. Organic burden may be added to the materials prior to inoculation with biological agent. The coupons will then be subjected to vacuum-based sampling according to protocols developed jointly by CDC and EPA. Recovery will be determined for each sampling method according to culture-based microbiological assays developed by CDC. All test parameters, such as test chamber size, coupon materials and sizes, sampling methods, methods of extraction / analysis will be determined by agreement among participating experts from EPA and CDC. The collective set of tests must be able to be completed within the allotted budget.

Table 1. Potential test parameters to vary during experiments

Parameter	Potential Variants
1. Vacuum-based Devices	At least two, and a maximum of three devices shall be evaluated in addition to the current HEPA sock vacuum collection device. The number of devices tested shall be maximized for the amount of available funding. Potential devices include the 37mm cassette-based collection device (MSE and/or PTFE filter membrane) and the 3M Trace Evidence Filter.
2. Material Surface Types	Three material types shall be evaluated with each sampling device. Potential material types include concrete, upholstery, and carpet (short and/or long pile).
3. Coupons and Replicates	1ft^2 or larger coupons shall be utilized for testing. Three coupons shall be sampled per replicate vacuum sample (i.e., 3 ft^2 surface area). The number of replicates shall be determined by the amount of effort and funding available. At least 10 replicate samples (30 total replicate coupons) shall be evaluated for each device and material type.
4. Test Organism	Spore-forming *Bacillus* species (*globigii, atrophaeus, subtilis*, etc.) shall be used as surrogate for *Bacillus anthracis* spores. One surrogate shall be selected for use in the entire study.

VIII. FACILITIES AND MATERIALS

All tasks described in this SOW shall be performed in-house, at the EPA's Research Triangle Park (RTP) facilities at 109 T.W. Alexander Dr., unless approved otherwise by

the EPA WAM. The sampling activities shall be conducted in the NHSRC's Decontamination Technologies Research Lab (DTRL) located in H-224, H-222, H-122a, and H-130a. The lab contains the necessary equipment for the tasks described herein. The analysis of the biological samples shall be conducted in the Microbiology lab, located in E-386, E-388, and E-390.

IX. TASKS

To achieve the desired objective of this effort, work for this SOW can be broken down into three tasks.

Task 1. Development of a Quality Assurance Project Plan (QAPP)
Project-specific details, including but not limited to number of tests, coupon materials, sampling strategies, analytical techniques, experimental controls, and coupon dosing method shall be outlined in a QAPP. The QAPP shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this WA package (see Attachment #1) and the NHSRC QA requirement as defined in Attachment #2. No experimentation shall begin before this task is approved by the EPA Quality Assurance Officer (QAO). Additional information related to QA requirements can be found at: http://www.epa.gov/quality/qs-docs/r5-final.pdf.

Task 2. Fabrication of Test Material Coupons
Materials shall then be fashioned into coupons for testing. 150 replicate coupons shall be fabricated for each material type.

Task 3. Test Experimentation – Vacuum Device Evaluation
At a minimum three vacuum-based sampling devices shall be evaluated for collection of biological agent (non-pathogenic *Bacillus* spores, as surrogate for *Bacillus anthracis*) from material surfaces. Agent will be deposited onto coupon surfaces by the aerosol deposition method developed by NHSRC. Three material types shall be tested for each sampling device. For these tests, experimentation shall be carried out in accordance with the QAPP. Deviations from the QAPP shall be documented in writing and justified. Testing shall begin within 15 working days of QAPP approval. Tests shall be completed within the period of performance.

X. MILESTONES, DELIVERABLES, AND COMPLETION DATES

QAPP
A draft QAPP and Work Plan shall be written within 15 working days of the award of this work assignment. This shall be provided prior to commencement of the tests described within this SOW. The combined QAPP and Work Plan shall include scope, scheduling, and costing information for each of the tests planned.

Data Reporting
The contractor shall design an MS Excel data reporting sheet template prior to the start of any work that conveys all relevant information from a test under Task 3. This template shall be approved by the EPA for use, prior to conducting any testing described in this

SOW. All photographs and videos shall be properly documented, indicating the exact tests in which they were taken. A log (in MS Excel) of all photographs and videos shall be maintained with the electronic files. The log shall include a description of each photograph and video, and include the test number and date. All electronic files shall be stored in a project folder set up on the EPA's DTRL share drive. All information relevant to a test (reporting sheet, digital photographs, videos, log file) shall be transmitted to the EPA WAM within 1 week from the completion of the sample analysis. These data shall have been QA/QC'd by the contractor prior to transmission. Transmission shall occur via e-mail to the EPA WAM informing him/her that the data is ready for viewing. In addition, a final comprehensive data summary shall be delivered to the WAM by March 31, 2012.

XI. RESPONSIBILITIES

The experimental work and reporting under this WA will be managed by the USEPA Office of Research and Development, National Homeland Security Research Center (NHSRC), Decontamination and Consequence Management Division (DCMD) in Research Triangle Park, NC. The U.S. EPA technical point of contact shall be Dr. M. Worth Calfee (phone 919-541-7600, email calfee.worth@epa.gov). The technical point of contact from the Centers for Disease Control and Prevention (CDC) shall be Ms. Laura Rose (phone 404-639-2161, email lmr8@cdc.gov), and Dr. Stephen Morse (email sam1@cdc.gov). Dr. Worth Calfee will be the Contracting Officer Representative.

Table 2. Example Test Matrix

Vacuum Device	Material	Replicate Test Coupons	Negative Controls	Total Coupons
1	A	10 (30 coupons)	1 (3 coupons)	33
	B	10 (30 coupons)	1 (3 coupons)	33
	C	10 (30 coupons)	1 (3 coupons)	33
2	A	10 (30 coupons)	1 (3 coupons)	33
	B	10 (30 coupons)	1 (3 coupons)	33
	C	10 (30 coupons)	1 (3 coupons)	33
3	A	10 (30 coupons)	1 (3 coupons)	33
	B	10 (30 coupons)	1 (3 coupons)	33
	C	10 (30 coupons)	1 (3 coupons)	33
4 (pending available funding)	A	10 (30 coupons)	1 (3 coupons)	33
	B	10 (30 coupons)	1 (3 coupons)	33
	C	10 (30 coupons)	1 (3 coupons)	33

XII. DELIVERABLES

Deliverables	Date
Draft QAPP	15 working days after award
Data Summary (all test data, QC'd)	March 31, 2012

NHSRC QUALITY ASSURANCE REQUIREMENTS FORM
Attachment 1 to the Statement of Work

I GENERAL INFORMATION

Title:	Evaluation of vacuum-based sampling Devices for collection of biological agent	
Description:	Work Assignment to support IA with CDC, evaluation of vacuum-based biological sampling devices	
Project ID:	DCMD 3.60	
Status:	Original	
Number Ammended:		
QA Category:	III	
Action Type:	Extramural	
Peer Review Category:	IV	
Security Classification:	Unclassified	
Project Type:	Sampling and Analysis	
QAPP Status 1:	Not Delivered	
Vehicle Status:	Existing Vehicle	
Vehicle Type:	Vehicle Number:	EP-C-09-027
	Work Assignment Number:	TBD
	Delivery/Task Order Number:	n/a
	Modification Number:	n/a
	Other:	n/a

*If you are processing an **IAG** or **CRADA**, the responsibility for QA must be negotiated within the agreement. The TLPs in consultation with the QAMs in the various organizations must agree on, and document, which organization will take the lead for QA, the names of the QAM and TLP from each organization, and the QA requirements that will be adhered to during the agreement. Include this info in the IAG/CRADA package.*

II SCOPE OF WORK

Yes — Does the Statement of Work contain the appropriate QA language?

The awardee shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action. The contractor shall prepare a QAPP in accordance with the R-2 and R-5 and/or the attachments provided with the SOW. The QAPP must be approved prior to the start of any work. Additional information related to QA requirements can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf

Yes — Does this extramural action involve the collection, generation, use, and/or reporting of environmental data; the design, construction, and operation of environmental technologies; or development of software, models, or methods?
(If "No" then skip to Section IV, and sign the form.)

No — Will the SOW or any subsequent work assignments or task orders involve any cross-organizational efforts within EPA?

No — Has a QAPP already been approved for the activities specified in the SOW?

No Is an applicable QAPP in the process of being prepared, revised, or approved by EPA personnel for future use by the contractor? (QA approval must be obtained before the contractor can start work.)

III QA DOCUMENTATION OPTIONS

All documentation specified under "Other" must be defined in the NHSRC Quality Management Plan and be consistent with requirements defined in EPA Manual 5360 A1. For all items checked below, there must be adequate information in the SOW (or its appendices) for the offeror to develop this documentation. Where applicable, reference a specific section of the SOW. *(R-2 refers to EPA Requirements for Quality Management Plans (QA/R-2) (EPA/240/B-01/002, 03/20/01) and R-5 refers to EPA Requirements for Quality Assurance Project Plans (QA/R-5) (EPA/240/B-01/003, 03/20/01). Copies of these documents are available at http://www.epa.gov/quality/qa_docs.html.)*

After Award Documentation

Not Applicable	Documentation of an organization's Quality System. QMP developed in accordance with:
Not Applicable	Combined documentation of an organization's Quality System and application of QA and QC to the single project covered by the contract: Developed in accordance with:
Other	Documentation of the application of QA and QC activities to applicable project(s). Developed in accordance with:
	Explain: The QAPP shall be developed in accordance with the attachment #1 (QAPP requirements)
	Programmatic QA Project Plan with supplements for each specific project, developed in accordance with:
Not Applicable	Existing documentation of the application of QA and QC activities will be used:

IV SIGNATURE BLOCK

The signatures below verify that the Statement of Work (SOW) has been reviewed to ascertain the necessary QA and QC activities required to comply with EPA Order 5360.1 A2, that the COR understands these requirements, and that the COR will ensure that the quality requirements indicated on the previous pages of this form are incorporated into all associated SOWs. *(Sign/date below, obtain a concurrence signature from the QA Staff, and submit the form along with the other extramural action documentation.)*

8/31/11		Ramona Hearn 8/31/11	
Worth Calfee NHSRC-DCMD Technical Lead Person	08/30/2011 Date	Eletha Roberts NHSRC-IO QA Staff Member	08/30/2011 Date

QAPP REQUIREMENTS FOR SAMPLING AND ANALYSIS PROJECTS

(from Appendix B of the NHSRC QMP)

A sampling and analysis activity or project is typically defined as a study performed to generate data to either monitor parameters on a routine basis or to characterize a particular population for later studies. The following requirements should be addressed as applicable.

SECTION 1.0, PROJECT DESCRIPTION AND ORGANIZATION

1.1 The purpose of the study shall be clearly stated in the sampling and analysis plan (SAP).

1.2 Responsibilities and points of contact for each organization shall be identified in the SAP. This should include identification of key

personnel and/or organization(s) responsible for sample collection and custody, analytical and/or process measurements, data reduction, report preparation, and quality assurance.

SECTION 2.0, SAMPLING

2.1 Sampling points for all measurements (*i.e.*, analytical, physical, and process, including locations and access points) shall be identified in the SAP whenever possible. If the specific locations cannot be identified at the time of plan generation, discuss the documentation and/or communication mechanism(s) for ensuring adequate information is captured to later identify sampling points.

2.2 The anticipated sampling frequency (*e.g.*, how many sampling events and how often events occur) and number of sample types (*e.g.*, metals, VOCs, SVOCs, *etc.*) taken at each event shall be provided.

2.3 The expected measurements (*i.e.*, specific analytes) planned for each sample type shall be summarized.

2.4 If applicable, known site-specific factors that may affect sampling procedures shall be described.

2.5 If applicable, any site preparation (*e.g.*, sampling device installation, sampling port modifications) needed prior to sampling shall be described.

2.6 Each sampling procedure to be used shall be discussed or referenced.

2.7 If compositing or splitting of samples is planned, the applicable procedures shall be described.

2.8 A list of sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis, shall be specified.

2.9 Containers used for sample collection, transport, and storage for each sample type shall be described.

2.10 Sample preservation methods (*e.g.*, refrigeration, acidification, *etc.*) shall be described.

2.11 Requirements for shipping samples shall be described.

2.12 Holding times requirements shall be noted.

2.13 Procedures for tracking samples in the laboratory and for maintaining chain-of-custody when samples are shipped shall be described. COC procedures shall be described to ensure that sample integrity is maintained (labeling, seals, records).

2.14 Information to be recorded and maintained by field personnel shall be discussed.

SECTION 3.0, TESTING AND MEASUREMENT PROTOCOLS

3.1 Each analytical method to be used shall be referenced. This includes EPA-approved and other validated nonstandard methods.

3.2 If applicable, modifications to EPA approved or other validated nonstandard methods shall also be described.

SECTION 4.0, QA/QC CHECKS

4.1 The SAP shall list and define all QC checks and/or procedures used for the project, both field and laboratory as needed.

4.2 For each specified QC check or procedure, required frequencies and acceptance criteria shall be included.

SECTION 5.0, DATA REDUCTION AND REPORTING

5.1 Data reduction procedures specific to the project, and also specific to each organization, shall be summarized.

5.2 The reporting requirements (*e.g.*, units, reporting method [*e.g.*, wet or dry]) for each measurement and matrix shall be identified.

SECTION 6.0, REPORTING REQUIREMENTS

The deliverables expected from each organization responsible for field and/or analytical activities shall be described.

Attachment # 2

NHSRC QA
To the Statement of Work

Requirements/Definitions List

EPAs Quality System Website: http://www.epa.gov/quality
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html
EPA's Quality System Website: http://www.epa.gov/quality/qs-docs/r5-final.pdf

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation described herein. All Quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approve the quality documentation. The Quality Assurance Project Plan (QAPP) shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government.

NHSRC's Quality System Specifications for Extramural Actions –

These requirements typically pertain to single project efforts. The five specifications are:

(1) **a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;**
(2) **an organizational chart showing the position of the QA function;**
(3) **delineation of the authority and responsibilities of the QA function;**
(4) **the background and experience of the QA personnel who will be assigned to the project; and**
(5) **the organization's general approach for accomplishing the QA specifications in the SOW.**

NHSRC QA Requirements/Definitions List
Category Level Designations (determines the level of QA required):

☐ **Category I Project** - applicable to studies performed to generate data used for enforcement activities, litigation, or research project involving human subjects. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

☐ **Category II Project** - applicable to studies performed to generate data used in support of the development of environmental regulations or standards. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

☐ **Category III Project** - applicable to projects involving applied research or technology evaluations. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP: QAPP** requirements for the specific project type (see below).

☐ **Category IV Project** - applicable to projects involving basic research or preliminary data gathering activities. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP QAPP** requirements for the specific project type (see below).

Project Types:

These outlines of NHSRC's QAPP Requirements for various project types, from Appendix B of the NHSRC QMP (except where otherwise noted), are condensed from typically applicable sections of R-5 (EPA Requirements for QA Project Plans) and are intended to serve as a starting point when preparing a QAPP. These lists and their format may not fit every research scenario and QAPP's must conform to applicable sections of R-5 in a way that fully describes the research plan and appropriate QA and QC measures to ensure that the data are of adequate quality and quantity to fit their intended purpose.

☐ **Applied Research Project** - pertains to a study performed to generate data to demonstrate the performance of accepted processes or technologies under defined conditions. These studies are often pilot- or field-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Applied Research Projects" from Appendix B of the NHSRC QMP.

☐ **Basic Research Project** - pertains to a study performed to generate data used to evaluate unproven theories, processes, or technologies. These studies are often bench-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Basic Research Projects" from Appendix B of the NHSRC QMP.

☐ **Design, Construction, and/or Operation of Environmental Technology Project** - pertains to environmental technology designed, constructed and/or operated by and/or for EPA. The QAPP shall address requirements in the EPA Quality System document "Guidance on Quality Assurance for Environmental Technology Design, Construction, and Operation" G-11, at http://www.epa.gov/quality/QS-docs/g11-final-05.pdf . For additional information, you may refer to Part C of "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology," ANSI/ASQC E4-1994, American Society for Quality Control, Milwaukee, WI, January 1995.

Geospatial Data Quality Assurance Project - pertains to data collection; data processing and analysis; and data validation of

☐ geospatial applications. The QAPP shall address requirements in the EPA Quality System document "Guidance for Geospatial Data Quality Assurance Project Plans" G-5S at http://www.epa.gov/quality/QS-docs/g5g-final-05.pdf.

☐ **Method Development Project** - pertains to situations where there is no existing standard method, or a standard method needs to be significantly modified for a specific application. The QAPP shall address all requirements listed in "QAPP Requirements for Method Development Projects" from Appendix B of the NHSRC QMP.

☐ **Model Development Project** - includes all types of mathematical models including static, dynamic, deterministic, stochastic, mechanistic, empirical, etc. The QAPP shall address requirements in the EPA Quality System document "Guidance for Quality Assurance Project Plans for Modeling" G-5M at http://www.epa.gov/quality/QS-docs/g5m-final.pdf.

☐ **Sampling and Analysis Project** - pertains to the collection and analysis of samples with no objectives other than to provide characterization or monitoring information. The QAPP shall address all requirements listed in "QAPP Requirements for Sampling and Analysis Projects" from Appendix B of the NHSRC QMP.

☐ **Secondary Data Project** - pertains to environmental data collected from other sources, by or for EPA, that are used for purposes other than those originally intended. Sources may include: literature, industry surveys, compilations from computerized databases and information systems, and computerized or mathematical models of environmental processes. The QAPP shall address all requirements listed in "QAPP Requirements for Secondary Data Projects" from Appendix B of the NHSRC QMP.

☐ **Software Development and Data Management Project** - pertains to software development, software/hardware systems development, database design and maintenance, data validation and verification systems. The QAPP shall address all requirements listed in "QAPP Requirements for Software Development Projects" from Appendix B of the NHSRC QMP.

Definitions:

Environmental Data - These are any measurement or information that describe environmental processes, location, or conditions; ecological or health effects directly from measurements, produced from software and models, and compiled from other sources such as data bases or the literature. For EPA, environmental data include information collected directly from measurements, produced from software and models, and compiled from other sources such as data bases or literature.

Incremental Funding - Incremental funding is partial funding, no new work.

Quality Assurance (QA) - Quality assurance is a system of management activities to ensure that a process, item, or service is of the type and quality needed by the customer. It deals with setting policy and running an administrative system of management controls that cover planning, implementation, and review of data collection activities and the use of data in decision making. Quality assurance is just one part of a quality system.

Quality Assurance Project Plan (QAPP) - A QAPP is a document that describes the necessary quality assurance, quality control, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. A QAPP documents project-specific information.

Quality Control (QC) - Quality control is a technical function that includes all the scientific precautions, such as calibrations and duplications, which are needed to acquire data of known and adequate quality.

Quality Management Plan (QMP) - A QMP is a document that describes an organization's/program's quality system in terms of the organizational structure, policy and procedures, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, documenting, and assessing all activities conducted. A QMP documents the overall organization/program, and is primarily applicable to multi-year, multi-project efforts. An organization's/program's QMP shall address all elements listed in the "Requirements for Quality Management Plans" in Appendix B of the NHSRC QMP.

Quality System - A quality system is the means by which an organization manages its quality aspects in a systematic, organized manner and provides a framework for planning, implementing, and assessing work performed by an organization and for carrying out required quality assurance and quality control activities.

R-2. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001 http://www.epa.gov/quality/QS-docs/r2-final.pdf.

R-5. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001 http://www.epa.gov/quality/QS-docs/r5-final.pdf.

Substantive Change - Substantive change is any change in an activity that may alter the quality of data being used, generated, or gathered.

Technical Lead Person (TLP) - This person is technically responsible for the project. For extramural contract work, the TLP is typically the contracting officer's representative (COR). For intramural work, the TLP is typically the Principal Investigator.

Abbreviations:

COR	Contracting Officer's Representative	IAG	Interagency Agreement
NHSRC	National Homeland Security Research Center	QA	Quality Assurance
NRMRL	National Risk Management Research Laboratory	QAM	Quality Assurance Manager
QA ID	Quality Assurance Identification	QMP	Quality Management Plan
QAPP	Quality Assurance Project Plan	SOW	Statement of Work
QS	Quality System	CRADA	Cooperative Research & Development Agreement
TLP	Technical Lead Person		

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-16

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2012 Base Option Period Number 2	Ozone SRP

Contractor: ARCADIS U.S., INC.

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Authorized Work Assignment Ceiling

Contract Period	Cost/Fee	LOE
04/01/2009 To 03/31/2012		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee	LOE
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Scott Moore (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-5104 FAX Number:
Project Officer Name: Larry Farmer (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3104 FAX Number:
Other Agency Official Name: (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Renita Tyus Renita Tyus 10/3/11 (Signature) (Date)	Branch/Mail Code: C.POD Phone Number: 513-487-2095 FAX Number: 513-487-2115

SOW FY 2011-2012
Period of Performance: 10/03/2011 – 03/31/2012
Work Assignment Manager (WAM): Scott A. Moore
Work Assignment Title: Ozone Standard Reference Photometer (SRP) Metrology Laboratory Support
Contract Number: EP-C-09-027
Work Assignment Number: 2-16

Introduction

In ambient air monitoring applications, gas concentration standards are required for the calibration and auditing of various ambient gas monitors. Because of the instability of ozone (O_3), the certification of O_3 concentrations as Standard Reference Materials (SRMs) is impossible. Therefore a Standard Reference Photometer (SRP) was developed as a primary standard to validate the linearity of other photometers when challenged with various concentrations of locally generated O_3 gas. An SOP (Standard Operating Proceedure) is being prepared to assist the EPA (Environmental Protection Agency) operators of the NIST (National Institute of Standards and Technology) Standard Reference Photometer (SRP) in terms of operation, repairs, and verification.
A collaborative effort between NIST and EPA in the development of the original SRPs has become the basis for O_3 measurements globally. The SRP Program began in the early 1980's as collaborative effort between NIST and the EPA to design, construct, certify, and deploy a network of identical O3 reference instruments. The design specifications called for an instrument with a standard uncertainty of ±2 nmol/mol (ppb_v) in the range of 0 nmol/mol to 100 nmol/mol and ±2% in the range of 100 nmol/mol to 1000 nmol/mol. Since the SRPs have been deployed, beginning in 1983; the performance of all SRP's has exceeded the design specifications. In the US, two (2) SRPs are maintained by NIST, one serving as the NIST standard and the other as a backup/travelling instrument. Eleven (11) additional SRPs are maintained by the EPA at various EPA Regional laboratories across the United States to facilitate requests for local access to authoritative (ie, NIST) reference standards. With current international network of SRPs total nearly fifty (50) SRPs worldwide that now includes instruments maintained in at least fifteen (15) countries. The international network is coordinated by the Bureau International des Poids et Mesures (BIPM) in France, which maintains the international responsibility for the comparison of national O_3 standards as the NIST does here in the United States.

Over the past several years, the network of NIST SRPs has undergone significant upgrades in its electronic systems, sampling configuration, and control software. Each SRP consists of a separate optical bench and two instrumentation modules (electronics and pneumatics). The UV photometer consists of a low-pressure mercury discharge lamp, UV filter, UV beam splitter, two absorption cells, and signal-processing electronics.
A new electronics module was designed as a plug-compatible replacement for the original unit to simplify upgrading of existing systems in May 2003. Several

improvements were made in the overall electronics module design to provide enhanced stability and to simplify operation.

I. Goal/Purpose

The objective of this Work Assignment (WA) is to provide support to the SRP Program (OAQPS) through the Metrology Laboratory (APPCD). This is a facility with the capabilities to validate and repair other SRPs in various regions in order to maintain NIST tractability. The following table has the Region Number, the location, the SRP Serial Number for that region and a contact name:

SRP	Region	Location	Name
8	8	Golden, CO	Michael Copeland
36	9	Richmond, CA	Barbara Bates
4	10	Sacromento, CA	Jerry Freeman
10	4	Athens, GA	Mike Crowe
1	RTP	RTP, NC	Scott Moore
7	RTP	SRP7 to NIST	Scott Moore
13	7	Kansas City, KS	James Regehr
9	1	N. Chelmsfield, MA	Chris St. Germain
6	5	Chicago, IL	Scott Hamilton
3	2	Edison, NJ	Avraham Teitz
5	6	Houston, TX	John Lay

Each year SRP-01 and SRP-07 are taken to NIST for their annual Validation. In turn, SRP-07 is then shipped around the country to be compared to each of the regional SRPs in order to provide NIST traceability. SRP-07 is shipped back to RTP in-between each regional comparison (or as often as possible) to check the status of the instrument. In turn various state and local authorities are able to go to a regional office to compare their lab standard or transfer standard and be able to maintain NIST tractability throughout the Ozone monitoring program.

II. Background Information

Data Uses — Primary users of the products of this WA will be researchers and operators of Ozone monitoring equipment in EPA/APPCD facilities. There are various groups that have Ozone monitoring equipment that may call on EPA for validation, such as Alion, Arcadis, the State of NC and the State of Florida and other local researchers.

Lab Site — Work area is D360-A in EPA's Research Center in Research Triangle Park, NC.

Experience Personnel assigned to this WA must be familiar with performing calibrations that the Metrology Laboratory can provide, which include electrical work, plumbing, general experience with lab equipment and materials, a familiarity with the calibration of measurement devices, and a fundamental understanding of the principals behind the measurements.

III. Tasks: OZONE SRP Laboratory Support

Task I. Shipping and Receiving of SRPs or other Ozone monitors

(1) The Contractor shall receive a SRP from one of the regions and unpack the equipment and set it up in D-360A in preparation of running a validation.

(2) The Contractor shall break down a SRP or Ozone monitor in preparation to ship the instrument or in preparation for the owner of the equipment to pick it up from D360-A

(3) All shipping is paid for by OAQPS, therefore the Contractor shall relay shipping information m (i.e. container size, weight, destination, date and priority) to OAQPS for labels to be printed. The Contractor shall make arrangement to have the equipment picked up or delivered to D360-A.

(4) Some travel may be required to get the SRP from one location to another without using a shipping company, in these rare instances the contractor shall make arrangement to travel to a specified location to pick or drop off the SRP.

(5) The Contractor shall become familiar with the Draft SOP for the SRP (provided by the WAM) and also the Draft: Transfer Standards for Calibration of Air Monitoring Analyzers for Ozone (PDF) (67pp, 820 KB) - May 31, 2009 as found on the website: http://www.epa.gov/ttn/amtic/srpqa.html

Task II. MetLab Operations

(1) The Contractor shall maintain the Zero Air Supply used for the Ozone Lab. OAQPS will be purchasing a new Zero Air Generator for the Ozone Lab. Once that is received and installed the contractor shall establish a monthly and annual routine maintenance schedule and log for it.

(2) The Contractor shall perform minor repairs on the SRPs as per Technical Directives from the WAM

(3) The Contractor shall maintain a calibration schedule for various support instrumentation such as the Barometric Pressure Sensor, the STOLAB Temperature calibrator and the Fluke Digital Volt Meter. OAQPS will be responsible for the costs of calibration of these instruments and the Contractor shall relay these costs to OAQPS

(4) The Contractor shall copy any written or verbal exchange to OAQPS to the WAM.

IV. Deliverables

Task I	The contractor will be notified via written technical direction
Task II	On-going

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-17

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2012 Base Option Period Number 2	Fenceline Monitoring

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2011 To 03/31/2012

Comments: Revised SOW to reduce LOE.

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

Note: To report additional accounting and appropriations data use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Cost/Fee:	LOE:
Contract Period: 04/01/2009 To 03/31/2012		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Eben Thoma (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-7969 FAX Number:
Project Officer Name: Diane Pierce (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Renita Tyus (Signature): Renita Tyus (Date): 12/13/11		Branch/Mail Code: CPSD Phone Number: 513-487-2094 FAX Number: 513-487-2109

Statement of Work: Deep UV Point Monitor Development

EP-C-09-027 WA 2-17 Amendment 1

This amendment adds new tasks and stops work on tasks as specified below.

Please refer to the original SOW of EP-C-09-027 WA 2-17 background information on this work assignment (WA) and for a description of current tasks.

Current Tasks

Actions:

- Extend the deliverable due date on Task 2 to March 31st, 2012
- Stop work on Tasks 3, 4, and 5.
- Add Task 6.

In order to deploy the prototype open path DUVOS system, EPA must secure the voluntary cooperation of an industrial facility collaborator. Due to delays in securing a cooperating facility, work on tasks to deploy the open path prototype cannot commence and general testing of the prototype has been delayed. A future WA amendment will reactivate tasks 3, 4, and 5 when a cooperating facility has been secured and the decision to reinitiate the field deployment has been made.

New Task:

Task 6: Support of point monitoring version of the DUVOS system.

Under the technical direction of the WAM, the contractor shall support development of a prototype point source monitor based on the DUVOS system. The point monitor is based on an EPA design. The contractor shall construct the unit as per EPA design and test the unit as per approved revised QAPP.

Work involving collection of environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff. The QA lead for The Quality Assurance Project Plan (QAPP) shall be a Category III level and must include all necessary elements as described in the referenced documentation (See Attachment 1).

Deliverable: The contractor shall construct the unit as per EPA design and test the unit as per the approved revised QAPP by March 31, 2012.

ATTACHMENT #1
TO THE STATEMENT OF WORK (SOW)

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD:

☐ **NRMRL=s Quality System Specifications:**

(1) a description of the organization=s Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization=s general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

☐ **NRMRL=s Quality System Specifications:**

(1) a description of the organization=s Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization=s general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

☐ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X **QAPP Requirements for Measurement Projects**

X **QAPP Requirements for Secondary Data Projects**

☐ **QAPP Requirements for Research Model Development and Application Projects**

☐ **QAPP Requirements for Software Development Projects**

X **QAPP Requirements for Method Development Projects**

☐ **QAPP Requirements for Design, Construction, and Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA=s Quality System Website: http://www.epa.gov/quality/

EPA=s Requirements and Guidance Documents:
http://www.epa.gov/quality/qa_docs.html

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS: Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.

4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.

4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.

4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.

4.5 Describe the method for uniquely numbering each sample.

4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5. MEASUREMENT PROCEDURES

5.1. Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.

5.2. If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6. QUALITY METRICS (QA/QC CHECKS)

6.1. For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

6.2. Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

7.2 Describe data validation procedures used to ensure the reporting of accurate project data.

7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).

7.3.1 If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

7.3.2 If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

7.4 Describe data storage requirements for both hard copy and electronic data.

8. REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-21

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2012 Base Option Period Number 2	Modification and Testing of Tr

Contractor	Specify Section and paragraph of Contract SOW
ARCADIS U.S., INC.	Section 3

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 12/13/2011 To 03/31/2012

Comments:
Full title: Modification and Testing of Transportable Gasifier for Animal Carcasses

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Cost/Fee:	LOE:
Contract Period: 04/01/2009 To 03/31/2012		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Shannon Serre	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-3817 FAX Number:
Project Officer Name: Diane Pierce	(Signature)	(Date)	Branch/Mail Code: Phone Number: FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Renita Tyus	Renita Tyus (Signature)	12/13/11 (Date)	Branch/Mail Code: CPaD Phone Number: 513-487-2094 FAX Number: 513-487-2109

STATEMENT OF WORK

MODIFICATION AND TESTING OF TRANSPORTABLE GASIFIER FOR ANIMAL CARCASSES

OMIS DCMD
(APPCD ON-SITE CONTRACT EP-C-09-027)
WA 2-21

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HOMELAND SECURITY RESEARCH CENTER
DECONTAMINATION AND CONSEQUENCE MANAGEMENT DIVISION

TABLE OF CONTENTS

I. TITLE

Modification and Testing of Transportable Gasifier for Animal Carcasses

II. PERIOD OF PERFORMANCE

The period of performance for the work under this work assignment shall be Award – 3/31/12.

III. SUMMARY OF OBJECTIVES

The objective of this work assignment is to make repairs and modifications to the gasification system, and to run an appropriate Proof of Concept test on swine and poultry in a real world environment.

IV. RELEVANCE

A comprehensive response strategy is required to effectively mitigate animal health emergencies (i.e. high –consequence foreign animal diseases) and maintain continuity of business to the maximum extent practicable. This response strategy must incorporate plans and technologies for rapid depopulation, decontamination, and disposal of affected animals. This technology could be used as a disposal option for animal carcasses following a disease outbreak.

V. BACKGROUND

This project is a combined effort between the Environmental Protection Agency (EPA) and the Department of Homeland Security (DHS). EPA and DHS are committed to using cutting edge technologies and scientific talent in our quest to make America safer.

A comprehensive response strategy is required to effectively mitigate animal health emergencies (i.e. high –consequence foreign animal diseases) and maintain continuity of business to the maximum extent practicable. This response strategy must incorporate plans and technologies for rapid depopulation, decontamination, and disposal of affected animals. Current response strategies which rely on stop-movement orders, quarantine, depopulation, carcass disposal, and limited application of available vaccines, are inadequate to meet the logistical challenges of large and/or multifocal outbreaks. Furthermore, these response efforts fail to manage or mitigate the psychological, social, economic, trade, social, or environmental consequences. There is a critical need to develop new and/or enhanced animal health emergency response strategies, tools, and technologies in order to increase capacity and to ensure that depopulation, decontamination, and disposal (3D) activities are handled as rapidly and as humanely as possible.

During the past five years, an interagency team, including USDA, the EPA, the Department of Defense (DoD), and the North Carolina Department of Agriculture and Consumer Services (NCDA&CS) has been collaborating on a project managed by the DoD's Technical Support Working Group (TSWG), involving the poultry and swine industries, to develop a technology to dispose of animal carcasses resulting from disease or natural disaster by mobile maceration and thermal gasification.

Early tests showed promise in a prototype equipment package designed and constructed to process 25 tons or more of swine or poultry carcasses in a day, with the system being expandable with multiple units to process up to 200 tons or more of carcasses daily. Initial field testing of the prototype indicated that many of the design requirements were successfully met and tested, but some design flaws in the prototype created limitations in achieving the desired feed rate.

This Scope of Work describes an effort to make needed repairs and modifications to the system, and to run an appropriate Proof of Concept test on swine and poultry in a real world environment. Such technology would provide the basis for strategically placed gasifier units around the country that could respond to diseases or disaster in a timely manner and provide an environmentally sound carcass disposal option.

With repair, enhancement, modification of the prototype system and effective training of an operating staff, the macerator and gasifier system should be able to safely process 25 tons or more of poultry or swine carcasses per day. The current prototype does not have the capability of processing large animal carcasses such as bovine or equine due to cost savings achieved on the macerator purchase that is with

the unit. The addition of a pre-breaker would enable large animals to be processed. Another important note is that the macerator unit is on a self-contained trailer and could be used in conjunction with other large-scale technologies that DHS might be interested in developing and testing.

The prototype is currently located at an agricultural industry site in North Carolina. Although some of the components (e.g., generator) have received routine maintenance, there has been some deterioration of some components due to the unit having not been operated for an extended period of time.

VI. SCOPE

The existing gasifier prototype shall be repaired to restore the components that are not being replaced in the activities of other tasks to their functional state. This shall include repair of the outer shell, refractory, ash discharge auger, trailers, control system, door assemblies, electrical components, generator, macerator, and feed system. All repairs shall be documented using Computer Aided Design (CAD) tools and all revised design drawings shall be collected into a system documentation manual in both electronic and hard copy form.

VII. TECHNICAL APPROACH

The contractor, upon approval from the EPA WAM, shall schedule a site visit with EPA personnel to examine the gasifier. The contractor shall then determine the repairs that are required to meet the objectives of this WA. A list of suggested repairs shall be submitted to the EPA WAM for consideration prior to initiating any repairs. Written authorization will be provided by WAM on repairs that shall be completed. Once the repairs have been completed a series of shakedown tests shall be planned based on discussions between the EPA WAM and the contractor.

VIII. AFFORDABILITY

This effort is labor intensive, which is where the bulk of the funding is required. The contractor shall determine which materials are necessary to repair the gasifier. Large capital equipment items will be procured by the EPA with smaller items being procured by the contractor. The unit is currently located in Rose Hill, NC and moving the unit is not financially feasible, so it may be necessary to subcontract with someone in the Rose Hill area to assist in repair/upgrade of the unit.

IX. TECHNICAL RISK

The technical risk involved in this project is minimal. The ultimate goal is to test the throughput operation of the gasifier using swine and poultry.

X. FACILITIES AND MATERIALS

All experimental efforts shall be performed by the contractor at the current location of the gasifier which is Rose Hill, NC. The system cannot be moved from its current location.

XI. TASKS

The following tasks are defined as part of this work assignment:

Task 1: Repair the damaged and deteriorated components of the gasifier prototype

The existing prototype shall be repaired to restore the components that are not being replaced in the activities of other tasks to their functional state. This shall include repair of the outer shell, refractory, ash discharge auger, trailers, control system, door assemblies, electrical components, generator, macerator, and feed system. All repairs shall be documented using Computer Aided Design (CAD) tools and all revised design drawings shall be collected into a system documentation manual in both electronic and hard copy form.

Task 2: Replace the oil-fired burners and associated equipment with gas-fired burners

The initial design decision to use oil-fired burners, although noble in its intent of minimizing logistics associated with fuel delivery by having the generator and burners use the same fuel, resulted in significant operational difficulties, including difficulty igniting, poor turndown ratios, and unreliable operation. The unit will be refitted with gas burners that burn LP or natural gas, and associated piping, fuel delivery, flame safety, and process control hardware. All new equipment installations will be

documented using Computer Aided Design (CAD) tools and all revised design drawings will be collected into a system documentation manual in both electronic and hard copy form.

Task 3: Modification of the feed system

The initial feed system design required manual actuation of the feeding valves from the top of the gasifier to distribute the feed onto the gasifier's hearth. The initial feed system also had a side effect that a volume of material equal to the amount of material fed into the macerator was introduced onto the hearths. This required paying significant attention to the introduction of material into the macerator, and caused operational difficulties when large animals were fed into the macerator. The feeding system shall be redesigned to decouple the quantity of material fed into the macerator from the quantity of material distributed onto the gasifier's hearth. In addition, the material transport system shall be re-evaluated to potentially use an auger rather than a pump. In addition, the control of the valves to distribute the feed across the gasifier hearths shall be automated with a manual override at ground level. The feed system shall be able to operate under negative draft to reduce the potential of contamination via aerosols escaping the system. All new equipment installations shall be documented using Computer Aided Design (CAD) tools and all revised design drawings shall be collected into a system documentation manual in both electronic and hard copy form.

Task 4: Modification of the macerator system

Upgrade of the processing macerator capability for bovine and equine carcasses by the addition or incorporation of a pre-breaker and associated infrastructure and transporting systems shall be required. The contractor shall recommend the required components and shall install these components as part of this task. Depending on budgetary constraints this Task will receive the lowest priority out of all the Tasks for this work assignment. All new equipment installations shall be documented using Computer Aided Design (CAD) tools and all revised design drawings will be collected into a system documentation manual in both electronic and hard copy form.

Task 5: Develop training materials for operational personnel

Training materials shall be developed for operational personnel to encompass mobilization, field assembly, operation, cleaning, maintenance, repairs, troubleshooting, and demobilization. Training materials shall be delivered in both hard copy and electronic forms.

Task 6: Evaluate and modify control system for the macerator and gasifier

The electrical system, control system, and associated equipment shall be tested and modified (if necessary) to assure that the gasifier can operate safely from a suitable location in all weather conditions. All new equipment installations shall be documented using Computer Aided Design (CAD) tools and all revised design drawings shall be collected into a system documentation manual in both electronic and hard copy form.

Task 7: Shakedown Testing

Once the modifications and repairs have been completed, the project operating team shall conduct a series of shakedown tests to optimize the performance of the unit, properly adjust the system, train personnel to safely and reliably operate it in the field, and perform at the highest throughput possible. Information shall be used to develop and design operations, maintenance, repair, assembly, disassembly and transportation material for reference and training. A Quality Assurance Project Plan shall be developed and approved, prior to any testing, to address any measurements to be taken as a part of this testing.

Task 8: Maximum Throughput Continuous Operation Test

The contractor shall carry out and document a three-day Proof of Concept (PoC) test at the highest throughput safely possible. It is anticipated that a 36 hour continuous test shall be required as part of this task. Upon completion of the test, the contractor shall clean and disinfect the equipment and test area, and prepare the system for relocation. The contractor shall prepare an After Action Report (AAR) based on the project activity and the results of the test. A Quality Assurance Project Plan shall be developed and approved, prior to testing, to address any measurements to be taken as a part of this testing.

Task 9: Documentation

As part of this task, the contractor shall evaluate and document the system, its operation, required maintenance, performance, and any other modifications or improvements. All new equipment installations shall be documented using Computer Aided Design (CAD) tools and all revised design drawings shall be collected into a system documentation manual in both electronic and hard copy form. A complete set of all of this documentation shall be placed with the unit in a weather protected container and provided to the project officer. It is anticipated that a total of 5 sets of documentation shall be provided.

Task 10: Clean, Decontaminate, Disassemble, Secure for Transport

The contractor shall clean, decontaminate, disassemble, and securely package the gasifier system, including macerator, for transport to a location identified by the North Carolina Department of Agriculture and Consumer Services for staging. If the Contractor does not have the capacity to transport the system once it is packaged, a heavy rigging/trucking company shall be hired by the contractor to transport and unload the system at the designated location. The location is anticipated to be in the Raleigh, NC area.

XII. DELIVERABLE SCHEDULE

- On a monthly basis for the duration of the project, the contractor shall submit, in electronic format, progress reports summarizing technical progress (including estimated percent of project completed), problems encountered, quarterly and cumulative financial expenditures and cost and schedule variance.

- A draft report shall be delivered to the EPA WAM within 6 weeks of the conclusion of Task 8.

Deliverable Schedule

Deliverable	Date
QAPP/Test Plan	1 month prior to beginning Task 7
Data summaries	On-going
Draft Report	6 weeks after conclusion of Task 8
Final Report	4 weeks after receiving comments from EPA

XIII. REPORTING REQUIREMENTS

- The Contractor shall prepare Quality Control data reports of all facility-specific data. Each Quality Control report shall be in a format suitable for EPA/NHSRC publication and shall discuss how well various measurements described in the QA plan were met.
- The awardee shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action, see attachment #1 and #2. The contractor shall prepare a QAPP in accordance with http://www.epa.gov/quality/qs-docs/r5-final.pdf or based on the type of research that is being conducted. For guidance on preparing a research-specific QAPP, the preparer should refer to the project specific requirements provided in NHSRC's QMP. The QAPP must be approved prior to the start of any laboratory work. Additional information related to QA requirements can be found at www.epa.gov/quality.
- The monthly invoice reports for this work assignment shall provide a detailed description of any equipment or expendables that have been purchased by the contractor for use on the projects discussed herein.
- All products developed under this SOW (e.g., the above mentioned technical report) must conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

NHSRC QUALITY ASSURANCE REQUIREMENTS FORM
Attachment 1 to the Statement of Work

I GENERAL INFORMATION

Title:	Modification and Testing of Transportable Gasifier for Animal Carcasses	
Description:	Modification of Transportable Gasifier	
Project ID:	DCMD 4.15	
Status:	Original	
Number Ammended:		
QA Category:	III	
Action Type:	Extramural	
Peer Review Category:	III	
Security Classification:	Unclassified	
Project Type:	Applied Research; Design/Construction/Operation of Environ. Technology	
QAPP Status 1:	Not Delivered	
Vehicle Status:	Existing Vehicle	
Vehicle Type:	Vehicle Number:	EP-C-09-027
	Work Assignment Number:	2-21
	Delivery/Task Order Number:	N/A
	Modification Number:	N/A
	Other:	N/A

*If you are processing an **IAG** or **CRADA**, the responsibility for QA must be negotiated within the agreement. The TLPs in consultation with the QAMs in the various organizations must agree on, and document, which organization will take the lead for QA, the names of the QAM and TLP from each organization, and the QA requirements that will be adhered to during the agreement. Include this info in the IAG/CRADA package.*

II SCOPE OF WORK

Yes — Does the Statement of Work contain the appropriate QA language?

The awardee shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action. The contractor shall prepare a QAPP in accordance with the R-2 and R-5 and/or the attachments provided with the SOW. The QAPP must be approved prior to the start of any work. Additional information related to QA requirements can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf

Yes — Does this extramural action involve the collection, generation, use, and/or reporting of environmental data; the design, construction, and operation of environmental technologies; or development of software, models, or methods?
(If "No" then skip to Section IV, and sign the form.)

No — Will the SOW or any subsequent work assignments or task orders involve any cross-organizational efforts within EPA?

No — Has a QAPP already been approved for the activities specified in the SOW?

Yes — Is an applicable QAPP in the process of being prepared, revised, or approved by EPA personnel for future use

by the contractor? (QA approval must be obtained before the contractor can start work.)

Provide the expected title for submission to QA staff for approval:
Modification and Testing of Transportable Gasifier for Animal Carcasses
Provide the approximate date for submission to QA staff for approval:
01/03/2012

III QA DOCUMENTATION OPTIONS

All documentation specified under "Other" must be defined in the NHSRC Quality Management Plan and be consistent with requirements defined in EPA Manual 5360 A1. For all items checked below, there must be adequate information in the SOW (or its appendices) for the offeror to develop this documentation. Where applicable, reference a specific section of the SOW. *(R-2 refers to EPA Requirements for Quality Management Plans (QA/R-2) (EPA/240/B-01/002, 03/20/01) and R-5 refers to EPA Requirements for Quality Assurance Project Plans (QA/R-5) (EPA/240/B-01/003, 03/20/01). Copies of these documents are available at http://www.epa.gov/quality/qa_docs.html.)*

After Award Documentation

Not Applicable	Documentation of an organization's Quality System. QMP developed in accordance with:
Not Applicable	Combined documentation of an organization's Quality System and application of QA and QC to the single project covered by the contract: Developed in accordance with:
Not Applicable	Documentation of the application of QA and QC activities to applicable project(s). Developed in accordance with:
The QAPP shall be developed in accordance with the attachment #1 (QAPP requirements for applied research projects)	Programmatic QA Project Plan with supplements for each specific project, developed in accordance with:
Not Applicable	Existing documentation of the application of QA and QC activities will be used:

IV SIGNATURE BLOCK

The signatures below verify that the Statement of Work (SOW) has been reviewed to ascertain the necessary QA and QC activities required to comply with EPA Order 5360.1 A2, that the COR understands these requirements, and that the COR will ensure that the quality requirements indicated on the previous pages of this form are incorporated into all associated SOWs. *(Sign/date below, obtain a concurrence signature from the QA Staff, and submit the form along with the other extramural action documentation.)*

Shannon Serre NHSRC-IO Technical Lead Person	12/05/2011 Date	Ramona Sherman NHSRC-IO QA Staff Member	12/05/2011 Date

QAPP REQUIREMENTS FOR APPLIED RESEARCH PROJECTS
(from Appendix B of the NHSRC QMP)

An applied research project is a study to demonstrate the performance of technologies under defined conditions. These studies are often pilot- or field-scale. The following requirements should be addressed as applicable.

SECTION 0.0, APPROVAL BY PROJECT PARTICIPANTS

The EPA Technical Lead Person (TLP) shall be responsible for obtaining signatures of appropriate project participants on the signature page of the QA plan, documenting agreement to project objectives and the approach for evaluating these objectives.

A distribution list shall be provided to facilitate the distribution of the most recent current version of the QAPP to all the principal project participants.

SECTION 1.0, PROJECT DESCRIPTION AND OBJECTIVES

1.1 The purpose of study shall be clearly stated.

1.2 The process, site, facility, and/or environmental system to be tested shall be described.

1.3 Project objectives shall be clearly stated and identified as primary or non-primary.

SECTION 2.0, PROJECT ORGANIZATION

2.1 Key points of contact for each organization involved in the project shall be identified.

2.2 All QA Managers and their relationship in the organizations (*i.e.*, location within each organization) shall be identified with evidence that the QA Manager is independent of project management.

2.3 Responsibilities of all other project participants and their relationship to other project participants shall be identified, meaning that organizations responsible for planning, coordination, sample collection, sample custody, measurements (*i.e.*, analytical, physical, and process), data reduction, data validation, and report preparation shall be clearly identified.

SECTION 3.0, EXPERIMENTAL APPROACH

3.1 The general approach and the test conditions for each experimental phase shall be provided. The statistical methods that will be used to evaluate the data (*i.e.*, ANOVA, or summary statistics) should be identified.

(NOTE: As deemed appropriate to the project by the TLP, the information requested in Sections 3.2, 3.3, and 3.4 may be presented here or in Section 4; the information requested in Sections 3.5 may be presented here or in Section 5; and the information requested in Sections 3.6 may be presented here or in Section 7.)

3.2 The sampling strategy shall be included and evidence must be presented to demonstrate that the strategy is appropriate for meeting primary project objectives, *i.e.*, a description of the statistical method or scientific rationale used to select sample sites and number of samples shall be provided.

3.3 Sampling/monitoring points for all measurements (*i.e.*, including locations and access points) shall be identified.

3.4 The frequency of sampling/monitoring events, as well as the numbers for each sample type and/or location shall be provided, including QC and reserve samples.

3.5 All measurements (*i.e.*, analytical [chemical, microbiological, assays], physical, and process) shall be identified for each sample type or process, and project-specific target analytes shall be listed and classified as critical or noncritical in the QAPP.

3.6 The planned approach (statistical and/or non-statistical) for evaluating project objectives shall be included.

SECTION 4.0, SAMPLING PROCEDURES

4.1 Whenever applicable, the method used to establish steady-state conditions shall be described.

4.2 Known site_specific factors that may affect sampling/monitoring procedures shall be described.

4.3 Any site preparation needed prior to sampling/monitoring shall be described.

4.4 Each sampling/monitoring procedure to be used shall be discussed or referenced. If compositing or splitting samples, those procedures shall be described.

4.5 For samples requiring a split sample for either QA/QC purposes or for shipment to a different laboratory, the QAPP shall identify who is responsible for splitting samples, and where the splitting is performed (*e.g.*, field versus lab).

4.6 If sampling/monitoring equipment is used to collect critical measurement data (*i.e.*, used to calculate the final concentration of a critical parameter), the QAPP shall describe how the sampling equipment is calibrated, the frequency at which it is calibrated, and the acceptance criteria for calibration or calibration verification, as appropriate.

4.7 If sampling/monitoring equipment is used to collect critical measurement data, the QAPP shall describe how cross-contamination between samples is avoided.

4.8 The QAPP shall include a discussion of the procedures to be used to assure that representative samples are collected.

4.9 A list of sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis, shall be specified.

4.10 Containers used for sample collection, transport, and storage for each sample type shall be described.

4.11 Describe how samples are uniquely identified.

4.12 Sample preservation methods (*e.g.*, refrigeration, acidification, *etc.*), including specific reagents, equipment, and supplies required for sample preservation shall be described.

4.13 Holding time requirements shall be noted.

4.14 Procedures for packing and shipping samples shall be described.

4.15 Procedures to maintain chain_of_custody (*e.g.*, custody seals, records) during transfer from the field to the laboratory, in the laboratory, and among contractors and subcontractors shall be described to ensure that sample integrity is maintained.

4.16 Sample archival requirements for each relevant organization shall be provided.

SECTION 5.0, TESTING AND MEASUREMENT PROTOCOLS

5.1 Each measurement method to be used shall be described in detail or referenced. Modifications to EPA_approved or similarly validated methods shall be specified.

5.2 For unproven methods, verification data applicable to expected matrices shall be included in the QAPP meaning the QAPP shall provide evidence that the proposed method is capable of achieving the desired performance.

5.3 For measurements which require a calibrated system, the QAPP shall include specific calibration procedures applicable to each project target analyte, and the procedures for verifying both initial and continuing calibrations (including frequency and acceptance criteria, and corrective actions to be performed if acceptance criteria are not met).

SECTION 6.0, QA/QC CHECKS

6.1 At a minimum, the QAPP shall include quantitative acceptance criteria for QA objectives associated with accuracy, precision, detection limits, and completeness for critical measurements (process, physical, and analytical, as applicable) for each matrix.

6.2 Any additional project-specific QA objectives shall be presented, including acceptance criteria. This includes items such as mass balance requirements.

6.3 The specific procedures used to assess all identified QA objectives shall be fully described.

6.4 The QAPP shall list and define all other QC checks and/or procedures (*e.g.*, blanks, surrogates, controls, *etc.*) used for the project, both field and laboratory.

6.5 For each specified QC check or procedure, required frequencies, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met shall be included.

SECTION 7.0, DATA REPORTING, DATA REDUCTION, AND DATA VALIDATION

7.1 The reporting requirements (*e.g.*, units, reporting method [wet or dry]) for each measurement and matrix shall be identified.

7.2 The deliverables expected from each organization responsible for field and laboratory activities shall be listed.

7.3 Data reduction procedures specific to the project, and also specific to each organization, shall be summarized.

7.4 Data validation procedures specific to each organization used to ensure the reporting of accurate project data to internal and external clients shall be summarized.

7.5 Data storage requirements for each organization shall be provided.

7.6 The product document that will be prepared for the project shall be specified (*e.g.*, journal article, final report, *etc.*). The contents of this document can be referenced to a NHSRC or program-specific QMP, if appropriate.

SECTION 8.0, ASSESSMENTS

8.1 The QAPP shall identify all scheduled audits (*i.e.*, both technical system audits [TSAs] and performance evaluations [PEs]) to be performed, who will perform these audits, and who will receive the audit reports.

8.2 The QAPP shall provide procedures that are to be followed that will ensure that necessary corrective actions will be performed.

8.3 The responsible party(-ies) for implementing corrective actions shall be identified.

SECTION 9.0, REFERENCES

References shall be provided either in the body of the text as footnotes or in a separate section.

Attachment # 2

NHSRC QA
To the Statement of Work
Requirements/Definitions List

EPAs Quality System Website: http://www.epa.gov/quality
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html
EPA's Quality System Website: http://www.epa.gov/quality/qs-docs/r5-final.pdf

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation described herein. All Quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approve the quality documentation. The Quality Assurance Project Plan (QAPP) shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government.

NHSRC's Quality System Specifications for Extramural Actions –

These requirements typically pertain to single project efforts. The five specifications are:

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function;
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

NHSRC QA Requirements/Definitions List
Category Level Designations (determines the level of QA required):

☐ **Category I Project** - applicable to studies performed to generate data used for enforcement activities, litigation, or research project involving human subjects. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

☐ **Category II Project** - applicable to studies performed to generate data used in support of the development of environmental regulations or standards. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

☑ **Category III Project** - applicable to projects involving applied research or technology evaluations. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP: QAPP** requirements for the specific project type (see below).

☐ **Category IV Project** - applicable to projects involving basic research or preliminary data gathering activities. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP** QAPP requirements for the specific project type (see below).

Project Types:

These outlines of NHSRC's QAPP Requirements for various project types, from Appendix B of the NHSRC QMP (except where otherwise noted), are condensed from typically applicable sections of R-5 (EPA Requirements for QA Project Plans) and are intended to serve as a starting point when preparing a QAPP. These lists and their format may not fit every research scenario and QAPP's must conform to applicable sections of R-5 in a way that fully describes the research plan and appropriate QA and QC measures to ensure that the data are of adequate quality and quantity to fit their intended purpose.

☑ **Applied Research Project** - pertains to a study performed to generate data to demonstrate the performance of accepted processes or technologies under defined conditions. These studies are often pilot- or field-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Applied Research Projects" from Appendix B of the NHSRC QMP.

☐ **Basic Research Project** - pertains to a study performed to generate data used to evaluate unproven theories, processes, or

technologies. These studies are often bench-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Basic Research Projects" from Appendix B of the NHSRC QMP.

☐ **Design, Construction, and/or Operation of Environmental Technology Project** - pertains to environmental technology designed, constructed and/or operated by and/or for EPA. The QAPP shall address requirements in the EPA Quality System document "Guidance on Quality Assurance for Environmental Technology Design, Construction, and Operation" G-11, at http://www.epa.gov/quality/QS-docs/g11-final-05.pdf. For additional information, you may refer to Part C of "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology," ANSI/ASQC E4-1994, American Society for Quality Control, Milwaukee, WI, January 1995.

☐ **Geospatial Data Quality Assurance Project** - pertains to data collection; data processing and analysis; and data validation of geospatial applications. The QAPP shall address requirements in the EPA Quality System document "Guidance for Geospatial Data Quality Assurance Project Plans" G-5S at http://www.epa.gov/quality/QS-docs/g5g-final-05.pdf.

☐ **Method Development Project** - pertains to situations where there is no existing standard method, or a standard method needs to be significantly modified for a specific application. The QAPP shall address all requirements listed in "QAPP Requirements for Method Development Projects" from Appendix B of the NHSRC QMP.

☐ **Model Development Project** - includes all types of mathematical models including static, dynamic, deterministic, stochastic, mechanistic, empirical, etc. The QAPP shall address requirements in the EPA Quality System document "Guidance for Quality Assurance Project Plans for Modeling" G-5M at http://www.epa.gov/quality/QS-docs/g5m-final.pdf.

☐ **Sampling and Analysis Project** - pertains to the collection and analysis of samples with no objectives other than to provide characterization or monitoring information. The QAPP shall address all requirements listed in "QAPP Requirements for Sampling and Analysis Projects" from Appendix B of the NHSRC QMP.

☐ **Secondary Data Project** - pertains to environmental data collected from other sources, by or for EPA, that are used for purposes other than those originally intended. Sources may include: literature, industry surveys, compilations from computerized databases and information systems, and computerized or mathematical models of environmental processes. The QAPP shall address all requirements listed in "QAPP Requirements for Secondary Data Projects" from Appendix B of the NHSRC QMP.

☐ **Software Development and Data Management Project** - pertains to software development, software/hardware systems development, database design and maintenance, data validation and verification systems. The QAPP shall address all requirements listed in "QAPP Requirements for Software Development Projects" from Appendix B of the NHSRC QMP.

Definitions:

Environmental Data - These are any measurement or information that describe environmental processes, location, or conditions; ecological or health effects directly from measurements, produced from software and models, and compiled from other sources such as data bases or the literature. For EPA, environmental data include information collected directly from measurements, produced from software and models, and compiled from other sources such as data bases or literature.

Incremental Funding - Incremental funding is partial funding, no new work.

Quality Assurance (QA) - Quality assurance is a system of management activities to ensure that a process, item, or service is of the type and quality needed by the customer. It deals with setting policy and running an administrative system of management controls that cover planning, implementation, and review of data collection activities and the use of data in decision making. Quality assurance is just one part of a quality system.

Quality Assurance Project Plan (QAPP) - A QAPP is a document that describes the necessary quality assurance, quality control, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. A QAPP documents project-specific information.

Quality Control (QC) - Quality control is a technical function that includes all the scientific precautions, such as calibrations and duplications, which are needed to acquire data of known and adequate quality.

Quality Management Plan (QMP) - A QMP is a document that describes an organization's/program's quality system in terms of the organizational structure, policy and procedures, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, documenting, and assessing all activities conducted. A QMP documents the overall organization/program, and is primarily applicable to multi-year, multi-project efforts. An organization's/program's QMP shall address all elements listed in the "Requirements for Quality Management Plans" in Appendix B of the NHSRC QMP.

Quality System - A quality system is the means by which an organization manages its quality aspects in a systematic, organized manner and provides a framework for planning, implementing, and assessing work performed by an organization and for carrying out required quality assurance and quality control activities.

R-2. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001 http://www.epa.gov/quality/QS-docs/r2-final.pdf.

R-5. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001 http://www.epa.gov/quality/QS-docs/r5-final.pdf.

Substantive Change - Substantive change is any change in an activity that may alter the quality of data being used, generated, or gathered.

Technical Lead Person (TLP) - This person is technically responsible for the project. For extramural contract work, the TLP is typically the contracting officer's representative (COR). For intramural work, the TLP is typically the Principal Investigator.

Abbreviations:

COR	Contracting Officer's Representative	IAG	Interagency Agreement
NHSRC	National Homeland Security Research Center	QA	Quality Assurance
NRMRL	National Risk Management Research Laboratory	QAM	Quality Assurance Manager
QA ID	Quality Assurance Identification	QMP	Quality Management Plan
QAPP	Quality Assurance Project Plan	SOW	Statement of Work
QS	Quality System	CRADA	Cooperative Research & Development Agreement
TLP	Technical Lead Person		

Attachment #2 to the Statement of Work
Revision 1. March 2006
NHSRC 06/02

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-24

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2012 Base Option Period Number 2	Evaluation of GHG strategies

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 11/08/2011 To 03/31/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2012 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Eben Thoma (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7969 FAX Number:
Project Officer Name: Larry Farmer (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3104 FAX Number:
Other Agency Official Name: (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Renita Tyus Renita Tyus (Signature) 11/8/11 (Date)	Branch/Mail Code: CPAD Phone Number: 513-487-2094 FAX Number: 513-487-2109

Work Assignment Form. (WebForms v1.0)

SOW

Development and evaluation of advanced strategies for assessment of greenhouse gas emissions

Background:

Development of advanced methods for assessment of greenhouse gas (GHG) emissions and sinks (i.e. CH_4, CO_2, N_2O, SF_6, CFC) from numerous source categories is an emerging national priority. Improved emission inventory information and mitigation strategy options are needed to inform GHG policy discussions and to provide guidance on rule implementation and potential future trading strategy verification schemes. Understanding the linkages and comparability between bottom-up and top-down inventories and verification strategies is of particular interest to EPA/ORD. This work assignment identifies and tests advanced flux measurement systems (in-situ and remote sensing), instrumentation systems, and models to investigate GHG sources and sinks in natural, agricultural, and industrial settings. Potential work areas include:

- Soil flux and canopy exchange
- Novel anthropogenic source strategies
- Sequestration field monitoring
- Emissions from wastewater and nutrient impacted natural systems
- Fugitive industrial sources
- Kilometer scale source/sink characterization

Tasks will be added to this work assignment as needed to address various aspects of this topic.

The contractor shall develop quality assurance documentation as required in Attachment #1 to this Statement of Work. Work involving environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff. The QAPP shall be a Category III level and must include all necessary elements as described in the Attachment.

Description of Tasks:

Task 1. Preparation of N_2O measurement system:

To improve information on soil N_2O production processes and emissions, the U.S. EPA is acquiring a state of the art Aerodyne isotopic N_2O measurement (dual QC laser). Under the technical direction of the WAM, the contractor shall prepare the system for laboratory testing which shall include the following:

- Communicate with vendor to understand facility needs
- Prepare space and infrastructure in the assigned laboratory
- Procure necessary supplies and gas standards
- Participate in installation and operational training for the system

- Develop operation, analysis, and field deployment SOPs
- Conduct laboratory QA testing of the systems and report results

Deliverable: Task 1 shall be complete within 90 days of WA initiation.

Task 2. Preparation for Local Field Study:

Under the technical direction of the WAM, the contractor shall prepare the instrument and experimental approach for execution of a 15 sample day field study on soil emissions in the RTP area. Preparation tasks shall include:

- Develop an high time resolution eddy covariance approach for acquisition of soil flux data
- Prepare instrument for field deployment to execute the approach
- Develop a quality assurance project plan with SOPs for executing the study.

Deliverable: Task 2 shall be complete within 60 days of Task 1 completion.

Task 3. Execution of Field Study:

The contractor shall execute a 15 sample-day field study at location as specified in Task 2.

Deliverable: Data analysis and short form report shall be complete within 60 days of field study completion.

ATTACHMENT #1
TO THE STATEMENT OF WORK (SOW)

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD:

☐ **NRMRLs Quality System Specifications:**

(1) a description of the organizations Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization=s general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

☐ **NRMRLs Quality System Specifications:**

(1) a description of the organizations Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization=s general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

☐ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X **QAPP Requirements for Measurement Projects**

☐ **QAPP Requirements for Secondary Data Projects**

☐ **QAPP Requirements for Research Model Development and Application Projects**

☐ **QAPP Requirements for Software Development Projects**

☐ **QAPP Requirements for Method Development Projects**

☐ **QAPP Requirements for Design, Construction, and Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA=s Quality System Website: http://www.epa.gov/quality/
EPA=s Requirements and Guidance Documents:
http://www.epa.gov/quality/qa_docs.html

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS: Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.

4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.
4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
4.5 Describe the method for uniquely numbering each sample.
4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5. MEASUREMENT PROCEDURES

5.1. Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.
5.2. If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6. QUALITY METRICS (QA/QC CHECKS)

6.1. For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.
6.2. Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.
7.2 Describe data validation procedures used to ensure the reporting of accurate project data.
7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).
  7.3.1 If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.
  7.3.2 If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.
7.4 Describe data storage requirements for both hard copy and electronic data.

8. REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-28

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2012 Base Option Period Number 2	Systematic Evaluation of Aggre

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 11/28/2011 To 03/31/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period:	Cost/Fee:	LOE:
04/01/2009 To 03/31/2012		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Sangdon Lee (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-4531 FAX Number:
Project Officer Name: Larry Farmer (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3104 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Renita Tyus Renita Tyus (Signature)	11/28/11 (Date)	Branch/Mail Code: C.POD Phone Number: 513-487-2094 FAX Number: 513-487-2109

STATEMENT OF WORK

Contract EP-C-09-027

I. TITLE

Systematic Evaluation of Aggressive Air Sampling for *Bacillus anthracis* Spores

II. PERIOD OF PERFORMANCE

The period of performance for the contract shall be from the date of award till the end of the contract option period.

III. SUMMARY OF OBJECTIVES

This work will provide data on the effectiveness of aggressive air sampling to sample *B. anthracis* spores on different materials and varied environmental conditions.

IV. RELEVANCE

This project will evaluate the aggressive air sampling (AAS) method to determine whether this technique is appropriate for *B. anthracis* spore sampling during the characterization and clearance process. This evaluation will identify the relative sampling efficacy of the AAS method for spore sampling as a function of surface type, spore surface concentration, and dissemination method. The AAS test results will be compared to selected surface sampling methods. From US Environmental Protection Agency (EPA)'s perspective, the aggressive air sampling method would be beneficial for numerous building interiors to be sampled rapidly and with fewer personnel. This aggressive air sampling method can potentially reduce the total number of samples per unit area compared to the current surface sampling methods.

V. BACKGROUND

The U.S. Department of Homeland Security (DHS) is committed to using cutting-edge technologies and scientific talent in its quest to make America safer. The DHS Science and Technology Directorate (S&T) is tasked with researching and organizing the scientific, engineering, and technological resources of the United States and leveraging these existing resources into technological tools to help protect the homeland. The EPA/National Homeland Security Research Center (NHSRC)/Decontamination Consequence Management Division (DCMD) through the project described in this Statement of Work supports this effort through DHS's Wide Area Recovery and Resiliency Program (WARRP) S&T program.

Protecting human health and the environment from the release of hazardous materials is the mission of the US Environmental Protection Agency (EPA). EPA's National Homeland Security Research Center (NHSRC) Decontamination Consequence

Management Division (DCMD) has developed a systematic decontamination research program to fulfill this mission. This project will evaluate the AAS method to determine whether this technique is appropriate for *B. anthracis* spore sampling during the clearance process.

The aggressive air sampling method would be beneficial for numerous building interiors for rapid sampling with fewer required personnel. This aggressive air sampling method can potentially reduce the total number of samples per unit area compared to the current surface sampling methods. In addition, sampling is one of the critical bottlenecks in the remediation process, thus AAS may result in a decrease in overall cleanup time. Results from this project will be used to provide the EPA Office of Emergency Management (OEM) and National Decontamination Team with a characterization and clearance sampling method to be employed during remediation efforts.

VI. SCOPE

The technical objective of this project is to evaluate the asbestos aggressive air sampling method for the application to *B. anthracis* spore sampling. The evaluation results will determine the efficacy of AAS as a function of surface type, spore surface loading and dissemination method. Sufficient replicates, blanks, and positive controls shall be used, consistent with standard microbiological and quality assurance procedures, past work conducted by the contractor, and studies being currently conducted by the contractor.

VII. TECHNICAL APPROACH

The current aggressive air sampling will be conducted in the presence of *B. anthracis* surrogate spores on the selected indoor and outdoor surface materials (The surface types of test coupons will be determined later by the project team). This project will include modifications to the AAS method used during Bioresponse Operational Testing and Evaluation (BOTE, phase I) project. Varied concentrations of surrogate spores will be deposited onto the target surface materials via aerosolization. The tests will be conducted in the indoor testing chamber (8' x 8' x 10') at EPA with controlled relative humidity and temperature. Spore sampling efficacy of the AAS will be measured as a function of three surface spore concentrations, at least three surface types, and two dissemination methods. The *anthracis* spore surface sampling methods will be applied to quantify the spore count on test surfaces and these results will be compared to AAS results. All experiments shall be approved by the EPA work assignment manager (WAM) prior to commencement. Test and analytical methods shall be adopted from past or on-going efforts, in consultation with the WAM.

VIII. TASKS

TASK 1. PREPARATION OF TEST/QA PLAN

The contractor shall prepare a Quality Assurance Project Plan (QAPP) in accordance with http://www.epa.gov/quality/qs-docs/r5-final.pdf or based on the type of research that is being conducted. This QAPP shall include a comprehensive work plan and a timetable for completion of the work. The QAPP, in addition to providing data quality objectives and indicators, will provide details on the test matrix, test methods and measurements as well as a project schedule. The EPA WAM will provide the test conditions including but not limited to the following parameters: surrogate spore type, surface types, testing surface size, spore loading levels, surface sampling methods, testing chamber environment, leaf blower operation pattern, and air samplers for AAS. The QAPP shall be submitted to the EPA WAM within 30 days of award of the task order and the plan shall be approved by the EPA QA officer prior to work with each decontaminant technology.

TASK 2. CONDUCTING EXPERIMENTS

The contractor shall conduct a total of 21 sampling tests using a simulant in the EPA's COntamination ManageMent And DEcontamination Room (COMMANDER). The test plan shall include the tests with 3 different loading levels, 3 different surface types, and 2 different dissemination methods. Tests for loading, dissemination, and surface type shall be conducted in duplicate. The target spore surface loadings shall range between 10^2 and 10^7 colony forming units (CFU) per ft^2. Each loading selected for testing shall be at least 10 times higher or less than other two loadings selected. Spores shall be disseminated via aerosolization using the particle aerosolization system. Two different dissemination methods shall be used to aerosolize dry and wet spores in the COMMANDER. Three surface types will be selected by EPA WAM and the selection will be made from indoor materials including but not limited to the following materials: carpet, laminate, painted dry wallboard, galvanized metal, ceiling tile, etc. The anthracis spore surface sampling methods shall be applied to quantify the spore count on test surfaces and the sampling results shall be compared to AAS results. The contractor shall use the procedures of surface sampling and AAS from BOTE I test plan and any changes in the method shall be consulted with EPA WAM.

In addition to the parametric tests, three tests of post-fumigation clearance sampling shall be conducted in the EPA COMMANDER. Fumigation type and initial spore loading level will be determined by EPA WAM. The contractor shall set up the COMMANDER into office or room environment. The COMMANDER shall be contaminated with the predetermined level of spores and then fumigated. The spores shall be sampled with the surface sampling methods and then AAS shall be applied. Two sampling results shall be compared.

IX. QUALITY ASSURANCE

The awardee shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action, see attachment #1 and #2. The contractor shall prepare a QAPP in accordance with

http://www.epa.gov/quality/qs-docs/r5-final.pdf or based on the type of research that is being conducted. For guidance on preparing a research-specific QAPP, the preparer should refer to the project specific requirements provided in NHSRC's QMP. The QAPP must be approved prior to the start of any laboratory work. Additional information related to QA requirements can be found at www.epa.gov/quality.

X. DELIVERABLE SCHEDULE

Task	Begin date	Completion Date
1. QAPP	As soon as WA awarded	1 month after WA award
2. Testing	Completion of QAPP	March 31st 2012

NHSRC QUALITY ASSURANCE REQUIREMENTS FORM
Attachment 1 to the Statement of Work

I GENERAL INFORMATION

Title:	Systematic Evaluation of Aggressive Air Sampling for Bacillus anthracis Spores
Description:	This project will evaluate the aggressive air sampling (AAS) method to determine whether this technique is appropriate for B. anthracis spore sampling during the characterization and clearance process. This evaluation will identify the relative sampling efficacy of the AAS method for spore sampling as a function of surface type, spore surface concentration, and dissemination method. The AAS test results will be compared to selected surface sampling methods. From US Environmental Protection Agency (EPA)'s perspective, the aggressive air sampling method would be beneficial for numerous building interiors to be sampled rapidly and with fewer personnel. This aggressive air sampling method can potentially reduce the total number of samples per unit area compared to the current surface sampling methods.
Project ID:	TBD
Status:	Original
Number Ammended:	
QA Category:	III
Action Type:	Extramural
Peer Review Category:	III; IV
Security Classification:	Unclassified
Project Type:	Applied Research; Basic Research
QAPP Status 1:	Not Delivered
Vehicle Status:	Existing Vehicle
Vehicle Type:	Vehicle Number: EP-C-09-027 Work Assignment Number: TBD Delivery/Task Order Number: n/a Modification Number: 0 Other: n/a

*If you are processing an **IAG** or **CRADA**, the responsibility for QA must be negotiated within the agreement. The TLPs in consultation with the QAMs in the various organizations must agree on, and document, which organization will take the lead for QA, the names of the QAM and TLP from each organization, and the QA requirements that will be adhered to during the agreement. Include this info in the IAG/CRADA package.*

II SCOPE OF WORK

Yes Does the Statement of Work contain the appropriate QA language?

The awardee shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action. The contractor shall prepare a QAPP in accordance with the R-2 and R-5 and/or the attachments provided with the SOW. The QAPP must be approved prior to the start of any work. Additional information related to QA requirements can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf

Yes Does this extramural action involve the collection, generation, use, and/or reporting of environmental data; the design, construction, and operation of environmental technologies; or development of software, models, or methods?

(If "No" then skip to Section IV, and sign the form.)

No	Will the SOW or any subsequent work assignments or task orders involve any cross-organizational efforts within EPA?
No	Has a QAPP already been approved for the activities specified in the SOW?
No	Is an applicable QAPP in the process of being prepared, revised, or approved by EPA personnel for future use by the contractor? (QA approval must be obtained before the contractor can start work.)

III QA DOCUMENTATION OPTIONS

All documentation specified under "Other" must be defined in the NHSRC Quality Management Plan and be consistent with requirements defined in EPA Manual 5360 A1. For all items checked below, there must be adequate information in the SOW (or its appendices) for the offeror to develop this documentation. Where applicable, reference a specific section of the SOW. *(R-2 refers to EPA Requirements for Quality Management Plans (QA/R-2) (EPA/240/B-01/002, 03/20/01) and R-5 refers to EPA Requirements for Quality Assurance Project Plans (QA/R-5) (EPA/240/B-01/003, 03/20/01). Copies of these documents are available at http://www.epa.gov/quality/qa_docs.html.)*

After Award Documentation

Not Applicable	Documentation of an organization's Quality System. QMP developed in accordance with:
Not Applicable	Combined documentation of an organization's Quality System and application of QA and QC to the single project covered by the contract: Developed in accordance with:
Other	Documentation of the application of QA and QC activities to applicable project(s). Developed in accordance with:
	Explain: The QAPPs shall be developed in accordance with the attachment #1 (QAPP requirements for applied research projects)
n/a	Programmatic QA Project Plan with supplements for each specific project, developed in accordance with:
Not Applicable	Existing documentation of the application of QA and QC activities will be used:

IV SIGNATURE BLOCK

The signatures below verify that the Statement of Work (SOW) has been reviewed to ascertain the necessary QA and QC activities required to comply with EPA Order 5360.1 A2, that the COR understands these requirements, and that the COR will ensure that the quality requirements indicated on the previous pages of this form are incorporated into all associated SOWs. *(Sign/date below, obtain a concurrence signature from the QA Staff, and submit the form along with the other extramural action documentation.)*

Sangdon Lee NHSRC-DCMD Technical Lead Person	10/17/2011 Date	Ramona Sherman NHSRC-IO QA Staff Member	11/09/2011 Date

QAPP REQUIREMENTS FOR APPLIED RESEARCH PROJECTS

(from Appendix B of the NHSRC QMP)

or field-scale. The following requirements should be addressed as applicable.

SECTION 0.0, APPROVAL BY PROJECT PARTICIPANTS

The EPA Technical Lead Person (TLP) shall be responsible for obtaining signatures of appropriate project participants on the signature page of the QA plan, documenting agreement to project objectives and the approach for evaluating these objectives.

A distribution list shall be provided to facilitate the distribution of the most recent current version of the QAPP to all the principal project participants.

SECTION 1.0, PROJECT DESCRIPTION AND OBJECTIVES

1.1 The purpose of study shall be clearly stated.

1.2 The process, site, facility, and/or environmental system to be tested shall be described.

1.3 Project objectives shall be clearly stated and identified as primary or non-primary.

SECTION 2.0, PROJECT ORGANIZATION

2.1 Key points of contact for each organization involved in the project shall be identified.

2.2 All QA Managers and their relationship in the organizations (*i.e.*, location within each organization) shall be identified with evidence that the QA Manager is independent of project management.

2.3 Responsibilities of all other project participants and their relationship to other project participants shall be identified meaning that organizations responsible for planning, coordination, sample collection, sample custody, measurements (*i.e.*, analytical, physical, and process), data reduction, data validation, and report preparation shall be clearly identified.

SECTION 3.0, EXPERIMENTAL APPROACH

3.1 The general approach and the test conditions for each experimental phase shall be provided. The statistical methods that will be used to evaluate the data (*i.e.*, ANOVA, or summary statistics) should be identified.

(NOTE: As deemed appropriate to the project by the TLP, the information requested in Sections 3.2, 3.3, and 3.4 may be presented here or in Section 4; the information requested in Sections 3.5 may be presented here or in Section 5; and the information requested in Sections 3.6 may be presented here or in Section 7.)

3.2 The sampling strategy shall be included and evidence must be presented to demonstrate that the strategy is appropriate for meeting primary project objectives, *i.e.*, a description of the statistical method or scientific rationale used to select sample sites and number of samples shall be provided.

3.3 Sampling/monitoring points for all measurements (*i.e.*, including locations and access points) shall be identified.

3.4 The frequency of sampling/monitoring events, as well as the numbers for each sample type and/or location shall be provided, including QC and reserve samples.

3.5 All measurements (*i.e.*, analytical [chemical, microbiological, assays], physical, and process) shall be identified for each sample type or process, and project-specific target analytes shall be listed and classified as critical or noncritical in the QAPP.

3.6 The planned approach (statistical and/or non-statistical) for evaluating project objectives shall be included.

SECTION 4.0, SAMPLING PROCEDURES

4.1 Whenever applicable, the method used to establish steady-state conditions shall be described.

4.2 Known site_specific factors that may affect sampling/monitoring procedures shall be described.

4.3 Any site preparation needed prior to sampling/monitoring shall be described.

4.4 Each sampling/monitoring procedure to be used shall be discussed or referenced. If compositing or splitting samples, those procedures shall be described.

4.5 For samples requiring a split sample for either QA/QC purposes or for shipment to a different laboratory, the QAPP shall identify who is responsible for splitting samples, and where the splitting is performed (*e.g.*, field versus lab).

4.6 If sampling/monitoring equipment is used to collect critical measurement data (*i.e.*, used to calculate the final concentration of a critical parameter), the QAPP shall describe how the sampling equipment is calibrated, the frequency at which it is calibrated, and the acceptance criteria for calibration or calibration verification, as appropriate.

4.7 If sampling/monitoring equipment is used to collect critical measurement data, the QAPP shall describe how cross-contamination between samples is avoided.

4.8 The QAPP shall include a discussion of the procedures to be used to assure that representative samples are collected.

4.9 A list of sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis, shall be specified.

4.10 Containers used for sample collection, transport, and storage for each sample type shall be described.

4.11 Describe how samples are uniquely identified.

4.12 Sample preservation methods (*e.g.*, refrigeration, acidification, *etc.*), including specific reagents, equipment, and supplies required for sample preservation shall be described.

4.13 Holding time requirements shall be noted.

4.14 Procedures for packing and shipping samples shall be described.

4.15 Procedures to maintain chain_of_custody (*e.g.*, custody seals, records) during transfer from the field to the laboratory, in the laboratory, and among contractors and subcontractors shall be described to ensure that sample integrity is maintained.

4.16 Sample archival requirements for each relevant organization shall be provided.

SECTION 5.0, TESTING AND MEASUREMENT PROTOCOLS

5.1 Each measurement method to be used shall be described in detail or referenced. Modifications to EPA_approved or similarly validated methods shall be specified.

5.2 For unproven methods, verification data applicable to expected matrices shall be included in the QAPP meaning the QAPP shall provide evidence that the proposed method is capable of achieving the desired performance.

5.3 For measurements which require a calibrated system, the QAPP shall include specific calibration procedures applicable to each project target analyte, and the procedures for verifying both initial and continuing calibrations (including frequency and acceptance criteria, and corrective actions to be performed if acceptance criteria are not met).

SECTION 6.0, QA/QC CHECKS

6.1 At a minimum, the QAPP shall include quantitative acceptance criteria for QA objectives associated with accuracy, precision, detection limits, and completeness for critical measurements (process, physical, and analytical, as applicable) for each matrix.

6.2 Any additional project-specific QA objectives shall be presented, including acceptance criteria. This includes items such as mass balance requirements.

6.3 The specific procedures used to assess all identified QA objectives shall be fully described.

6.4 The QAPP shall list and define all other QC checks and/or procedures (*e.g.*, blanks, surrogates, controls, *etc.*) used for the project, both field and laboratory.

6.5 For each specified QC check or procedure, required frequencies, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met shall be included.

SECTION 7.0, DATA REPORTING , DATA REDUCTION , AND DATA VALIDATION

7.1 The reporting requirements (*e.g.*, units, reporting method [wet or dry]) for each measurement and matrix shall be identified.

7.2 The deliverables expected from each organization responsible for field and laboratory activities shall be listed

7.3 Data reduction procedures specific to the project, and also specific to each organization, shall be summarized.

7.4 Data validation procedures specific to each organization used to ensure the reporting of accurate project data to internal and external clients shall be summarized.

7.5 Data storage requirements for each organization shall be provided.

7.6 The product document that will be prepared for the project shall be specified (*e.g.*, journal article, final report, *etc.*). The contents of this document can be referenced to a NHSRC or program-specific QMP, if appropriate.

SECTION 8.0, ASSESSMENTS

8.1 The QAPP shall identify all scheduled audits (*i.e.*, both technical system audits [TSAs] and performance evaluations [PEs]) to be performed, who will perform these audits, and who will receive the audit reports.

8.2 The QAPP shall provide procedures that are to be followed that will ensure that necessary corrective actions will be performed.

8.3 The responsible party(-ies) for implementing corrective actions shall be identified.

SECTION 9.0, REFERENCES

References shall be provided either in the body of the text as footnotes or in a separate section.

QAPP REQUIREMENTS FOR BASIC RESEARCH PROJECTS
(from Appendix B of the NHSRC QMP)

A basic research project is a study performed to generate data used to evaluate unproven theories, processes, or technologies.

SECTION 1.0, PROJECT OBJECTIVES AND ORGANIZATION

1.1 State the project objectives.

1.2 Identify the responsibilities of all project participants (*e.g*, QAPP preparation, sample collection and analyses, data reduction/validation/analysis, report preparation, QA).

SECTION 2.0, EXPERIMENTAL APPROACH

2.1 Describe the process, site, facility, apparatus, and/or environmental system to be tested.

2.2 Describe all known or pre-established test conditions and variables, including replicate experimental runs.

2.3 Describe the planned approach (statistical and/or non-statistical) for evaluating project objectives (*i.e.*, data analysis).

SECTION 3.0, SAMPLING AND MEASUREMENT APPROACH AND PROCEDURES

3.1 Complete the following table to summarize the sampling strategy to be used.

Sample/Measurement Location	Matrix	Measurement	Frequency	Experimental QC1	Total No. Samples

1QC samples generated during experiment, as applicable (*e.g.*, blanks, replicate samples, spikes)

3.2 Complete the following table to summarize the sampling and analytical procedures to be used.

Matrix	Measurement	Sampling/ Measurement Method1	Analysis Method1	Sample Container/ Quantity of Sample	Preservation/ Storage	Holding Time(s)2

1Provide details in text, as necessary, if standard method or SOP cannot be referenced
2Both to extraction and analysis, if applicable

SECTION 4.0, QA/QC CHECKS

Complete the following table to summarize QA/QC checks.

Matrix	Measurement	QA/QC Check1	Frequency	Acceptance Criteria	Corrective Action

1Include all QA/QC checks (experimental and analytical, as applicable) for accuracy, precision, detection limits, mass balance, *etc.* (*e.g.*, matrix spikes, lab control samples, blanks, replicates, surrogates)

SECTION 5.0, DATA REPORTING

Describe data reduction procedures specific to the project.

SECTION 6.0, REFERENCES

Provide references to methods and germane prior publications.

IN ADDITION, WHEN APPLICABLE ...

- list all project-specific target analytes (*i.e.*, when a class of compounds is specified in the table)
- indicate if reporting is on a wet or dry weight basis (solid matrices only)
- describe the method used to establish steady-state conditions
- describe how sampling equipment is calibrated
- describe how cross-contamination between samples is avoided
- describe the procedures used to collect representative samples
- describe sample packing and shipping procedures
- describe instrument calibration procedures and acceptance criteria if not included in a referenced method or SOP.

Attachment # 2

NHSRC QA
To the Statement of Work
Requirements/Definitions List

EPAs Quality System Website: http://www.epa.gov/quality
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html
EPA's Quality System Website: http://www.epa.gov/quality/qs-docs/r5-final.pdf

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation described herein. All Quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approve the quality documentation. The Quality Assurance Project Plan (QAPP) shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government.

NHSRC's Quality System Specifications for Extramural Actions –

These requirements typically pertain to single project efforts. The five specifications are:

(1) **a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;**
(2) **an organizational chart showing the position of the QA function;**
(3) **delineation of the authority and responsibilities of the QA function;**
(4) **the background and experience of the QA personnel who will be assigned to the project; and**
(5) **the organization's general approach for accomplishing the QA specifications in the SOW.**

NHSRC QA Requirements/Definitions List
Category Level Designations (determines the level of QA required):

☐ **Category I Project** - applicable to studies performed to generate data used for enforcement activities, litigation, or research project involving human subjects. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

☐ **Category II Project** - applicable to studies performed to generate data used in support of the development of environmental regulations or standards. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

☐ **Category III Project** - applicable to projects involving applied research or technology evaluations. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP: QAPP** requirements for the specific project type (see below).

☐ **Category IV Project** - applicable to projects involving basic research or preliminary data gathering activities. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP QAPP** requirements for the specific project type (see below).

Project Types:

These outlines of NHSRC's QAPP Requirements for various project types, from Appendix B of the NHSRC QMP (except where otherwise noted), are condensed from typically applicable sections of R-5 (EPA Requirements for QA Project Plans) and are intended to serve as a starting point when preparing a QAPP. These lists and their format may not fit every research scenario and QAPP's must conform to applicable sections of R-5 in a way that fully describes the research plan and appropriate QA and QC measures to ensure that the data are of adequate quality and quantity to fit their intended purpose.

☐ **Applied Research Project** - pertains to a study performed to generate data to demonstrate the performance of accepted processes or technologies under defined conditions. These studies are often pilot- or field-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Applied Research Projects" from Appendix B of the NHSRC QMP.

☐ **Basic Research Project** - pertains to a study performed to generate data used to evaluate unproven theories, processes, or technologies. These studies are often bench-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Basic Research Projects" from Appendix B of the NHSRC QMP.

☐ **Design, Construction, and/or Operation of Environmental Technology Project** - pertains to environmental technology designed, constructed and/or operated by and/or for EPA. The QAPP shall address requirements in the EPA Quality System document "Guidance on Quality Assurance for Environmental Technology Design, Construction, and Operation" G-11, at http://www.epa.gov/quality/QS-docs/g11-final-05.pdf. For additional information, you may refer to Part C of "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology," ANSI/ASQC E4-1994, American Society for Quality Control, Milwaukee, WI, January 1995.

☐ **Geospatial Data Quality Assurance Project** - pertains to data collection; data processing and analysis; and data validation of geospatial applications. The QAPP shall address requirements in the EPA Quality System document "Guidance for Geospatial Data Quality Assurance Project Plans" G-5S at http://www.epa.gov/quality/QS-docs/g5g-final-05.pdf.

☐ **Method Development Project** - pertains to situations where there is no existing standard method, or a standard method needs to be significantly modified for a specific application. The QAPP shall address all requirements listed in "QAPP Requirements for Method Development Projects" from Appendix B of the NHSRC QMP.

☐ **Model Development Project** - includes all types of mathematical models including static, dynamic, deterministic, stochastic, mechanistic, empirical, etc. The QAPP shall address requirements in the EPA Quality System document "Guidance for Quality Assurance Project Plans for Modeling" G-5M at http://www.epa.gov/quality/QS-docs/g5m-final.pdf.

☐ **Sampling and Analysis Project** - pertains to the collection and analysis of samples with no objectives other than to provide characterization or monitoring information. The QAPP shall address all requirements listed in "QAPP Requirements for Sampling and Analysis Projects" from Appendix B of the NHSRC QMP.

☐ **Secondary Data Project** - pertains to environmental data collected from other sources, by or for EPA, that are used for purposes other than those originally intended. Sources may include: literature, industry surveys, compilations from computerized databases and information systems, and computerized or mathematical models of environmental processes. The QAPP shall address all requirements listed in "QAPP Requirements for Secondary Data Projects" from Appendix B of the NHSRC QMP.

☐ **Software Development and Data Management Project** - pertains to software development, software/hardware systems development, database design and maintenance, data validation and verification systems. The QAPP shall address all requirements listed in "QAPP Requirements for Software Development Projects" from Appendix B of the NHSRC QMP.

Definitions:

Environmental Data - These are any measurement or information that describe environmental processes, location, or conditions; ecological or health effects directly from measurements, produced from software and models, and compiled from other sources such as data bases or the literature. For EPA, environmental data include information collected directly from measurements, produced from software and models, and compiled from other sources such as data bases or literature.

Incremental Funding - Incremental funding is partial funding, no new work.

Quality Assurance (QA) - Quality assurance is a system of management activities to ensure that a process, item, or service is of the type and quality needed by the customer. It deals with setting policy and running an administrative system of management controls that cover planning, implementation, and review of data collection activities and the use of data in decision making. Quality assurance is just one part of a quality system.

Quality Assurance Project Plan (QAPP) - A QAPP is a document that describes the necessary quality assurance, quality control, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. A QAPP documents project-specific information.

Quality Control (QC) - Quality control is a technical function that includes all the scientific precautions, such as calibrations and duplications, which are needed to acquire data of known and adequate quality.

Quality Management Plan (QMP) - A QMP is a document that describes an organization's/program's quality system in terms of the organizational structure, policy and procedures, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, documenting, and assessing all activities conducted. A QMP documents the overall organization/program, and is primarily applicable to multi-year, multi-project efforts. An organization's/program's QMP shall address all elements listed in the "Requirements for Quality Management Plans" in Appendix B of the NHSRC QMP.

Quality System - A quality system is the means by which an organization manages its quality aspects in a systematic, organized manner and provides a framework for planning, implementing, and assessing work performed by an organization and for carrying out required quality assurance and quality control activities.

R-2. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001 http://www.epa.gov/quality/QS-docs/r2-final.pdf.

R-5. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001 http://www.epa.gov/quality/QS-docs/r5-final.pdf.

Substantive Change - Substantive change is any change in an activity that may alter the quality of data being used, generated, or gathered.

Technical Lead Person (TLP) - This person is technically responsible for the project. For extramural contract work, the TLP is typically the contracting officer's representative (COR). For intramural work, the TLP is typically the Principal Investigator.

Abbreviations:

COR	Contracting Officer's Representative	IAG	Interagency Agreement
NHSRC	National Homeland Security Research Center	QA	Quality Assurance
NRMRL	National Risk Management Research Laboratory	QAM	Quality Assurance Manager
QA ID	Quality Assurance Identification	QMP	Quality Management Plan
QAPP	Quality Assurance Project Plan	SOW	Statement of Work
QS	Quality System	CRADA	Cooperative Research & Development Agreement
TLP	Technical Lead Person		

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-29

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2012 Base Option Period Number 2	Development of Automated Floor

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 11/28/2011 To 03/31/2012

Comments:

[ ] Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): [ ]

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2012 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Sangdon Lee (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-4531 FAX Number:
Project Officer Name: Larry Farmer (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3104 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Renita Tyus Renita Tyus 11/28/11 (Signature) (Date)	Branch/Mail Code: CPAD Phone Number: 513-487-2094 FAX Number: 513-487-2109

STATEMENT OF WORK

Contract EP-C-09-027

I. TITLE

Development of Automated Floor Sampling Device for *Bacillus anthracis* Spores

II. PERIOD OF PERFORMANCE

The period of performance for the contract shall be from the date of award till the end of the contract option period.

III. SUMMARY OF OBJECTIVES

This work will produce a prototype automated floor sampling device and data on the effectiveness of the device to sample *B. anthracis* spores on different materials and varied environmental conditions.

IV. RELEVANCE

The proposed sampling device would be beneficial following wide-area attacks, where deploying a robotic vacuum sampler would allow large areas of outdoor space as well as numerous building interiors to be sampled rapidly and without the need for large numbers of personnel. These samplers would likely generate one sample each (per deployment), and would yield data that would "rule in" or "rule out" an area or building with regards to contamination (i.e., help delineate the hot, warm, cold zones prior to decontamination). Since they collect a single sample per deployment, they should NOT pose an enormous burden on sample processing labs (sampling and sample processing is a significant bottleneck in recovery timelines). Composite sampling such as proposed here would be an economic means for sampling numerous buildings and large surface areas.

V. BACKGROUND

The U.S. Department of Homeland Security (DHS) is committed to using cutting-edge technologies and scientific talent in its quest to make America safer. The DHS Science and Technology Directorate (S&T) is tasked with researching and organizing the scientific, engineering, and technological resources of the United States and leveraging these existing resources into technological tools to help protect the homeland. The EPA/National Homeland Security Research Center (NHSRC)/Decontamination Consequence Management Division (DCMD)/Systematic Development of Automated Floor Sampling Device (AFSD) for *Bacillus anthracis* Spores supports this effort through DHS's Wide Area Recovery and Resiliency Program (WARRP) S&T program.

The aerodynamic diameter of a single *Bacillus anthracis* spore is approximately 1 μm. Particles consisting of one spore or a number of spores and other matter settle down to

horizontal surfaces such as floors due to the influence of gravitational force. Since floors constitute a majority of the horizontal surfaces inside most facilities, floor sampling is crucial to characterize sites contaminated with a biological agent such as *B. anthracis*.

The existing spore sampling strategy requires the use of varied methods depending on the type of surface, e.g. vacuuming for rough and porous surfaces and wet wipes for smooth nonporous surfaces. These methods are used to characterize contaminated sites and are laborious due to the large number of samples collected. This large number is due to the limited area per sampling. The number of samples can easily reach hundreds to thousands for characterization of a large commercial building. Large number of samples can delay the cleanup process for anthrax-contaminated areas. This project will develop an automated floor sampling device for *B. anthracis* spores by adapting a robotic vacuum cleaner.

VI. SCOPE

The technical objective of this project is to develop an automated floor sampling device and test its sampling efficacy of *anthracis* spores on floors. Sufficient replicates, blanks, and positive controls shall be used, consistent with standard microbiological and quality assurance procedures, past work conducted by the contractor, and studies being currently conducted by the contractor.

VII. TECHNICAL APPROACH

The contractor shall evaluate the commercially available autonomous (robotic) vacuum cleaners using the criteria provided by the EPA WAM. The contractor shall select the top three vacuum cleaners. The contractor shall test three autonomous (robotic) vacuum cleaners for anthracis spore sampling efficacy in the laboratory. The top one or two highly efficient cleaners shall be modified to improve its collection efficacy by replacing the filtration system or/and addition of surface agitation equipment. A series of laboratory tests shall be conducted to evaluate the modified vacuum samplers. The most efficient modified vacuum sampler shall be optimized for vacuuming speed and surface agitation property to maximize the sampling efficacy. This optimized device shall be tested for its sampling efficiency as a function of spore surface loading and floor types. All experiments shall be approved by the EPA work assignment manager (WAM) prior to commencement. Test and analytical methods shall be adopted from past or on-going efforts, in consultation with the WAM.

VIII. TASKS

TASK 1. PREPARATION OF TEST/QA PLAN

The contractor shall prepare a Quality Assurance Project Plan (QAPP) in accordance with http://www.epa.gov/quality/qs-docs/r5-final.pdf or based on the type of research that is being conducted. This QAPP shall include a comprehensive work plan and a timetable

for completion of the work. The QAPP, in addition to providing data quality objectives and indicators, will provide details on the test matrix, test methods and measurements as well as a project schedule. The EPA WAM will provide the test parameters including but not limited to the following test parameters: surrogate spore type, vacuum cleaner selection criteria, surface types, testing surface size, loading levels, and testing chamber environment. The QAPP shall be submitted to the EPA WAM within 30 days of award of the task order and the plan shall be approved by the EPA QA officer prior to work with each decontaminant technology.

TASK 2. SELECTION OF ROBOTIC VACUUM CLEANERS FOR TEST

Commercially available robotic vacuum cleaners shall be reviewed according to the criteria determined by the EPA WAM. From the information collected, three top ranked vacuum cleaners shall be tested for its sampling efficacy. Laboratory tests shall be conducted to compare the criteria developed by the EPA WAM among three selected vacuum cleaners. The surface size, surface type and number, surrogate spore, deposition process, and vacuum operation time shall be determined before testing by EPA WAM. The vacuum cleaner(s) which best meets the criteria shall be selected from this test for further modification and optimization.

TASK 3. MODIFICATION AND OPTIMIZATION OF ROBOTIC VACUUM CLEANER FOR SURFACE SPORE SAMPLING

The selected vacuum cleaner(s) from Task 2 shall be modified to include a HEPA filter (if not available from the selected vacuum cleaner). The surface agitation system shall be designed and tested for its surface particle resuspension capability in a laboratory using surrogate spore particles. The test shall be conducted on one surface type selected by the EPA WAM. The surface agitation system shall be attached to the vacuum cleaner and adjusted for optimal sampling operation.

IX. QUALITY ASSURANCE

The awardee shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action, see attachment #1 and #2. The contractor shall prepare a QAPP in accordance with http://www.epa.gov/quality/qs-docs/r5-final.pdf or based on the type of research that is being conducted. For guidance on preparing a research-specific QAPP, the preparer should refer to the project specific requirements provided in NHSRC's QMP. The QAPP must be approved prior to the start of any laboratory work. Additional information related to QA requirements can be found at www.epa.gov/quality.

X. DELIVERABLE SCHEDULE

Task	Begin date	Completion Date
1. QAPP	As soon as WA awarded	1 month after WA award
2. Vacuum selection	Completion of QAPP	February 28th 2012
3. Modification	Completion of QAPP	March 31st 2012

NHSRC QUALITY ASSURANCE REQUIREMENTS FORM
Attachment 1 to the Statement of Work

I GENERAL INFORMATION

Title:	Development of Automated Floor Sampling Device for Bacillus anthracis Spores
Description:	The technical objective of this project is to develop an automated floor sampling device and test its sampling efficacy of anthracis spores on floors. Sufficient replicates, blanks, and positive controls shall be used, consistent with standard microbiological and quality assurance procedures, past work conducted by the contractor, and studies being currently conducted by the contractor.
Project ID:	TBD
Status:	Original
Number Ammended:	
QA Category:	III
Action Type:	Extramural
Peer Review Category:	III; IV
Security Classification:	
Project Type:	Applied Research; Basic Research
QAPP Status 1:	Not Delivered
Vehicle Status:	Existing Vehicle
Vehicle Type:	Vehicle Number: EP-C-09-023 Work Assignment Number: TBD Delivery/Task Order Number: n/a Modification Number: 0 Other: n/a

*If you are processing an **IAG** or **CRADA**, the responsibility for QA must be negotiated within the agreement. The TLPs in consultation with the QAMs in the various organizations must agree on, and document, which organization will take the lead for QA, the names of the QAM and TLP from each organization, and the QA requirements that will be adhered to during the agreement. Include this info in the IAG/CRADA package.*

II SCOPE OF WORK

Yes Does the Statement of Work contain the appropriate QA language?

The awardee shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action. The contractor shall prepare a QAPP in accordance with the R-2 and R-5 and/or the attachments provided with the SOW. The QAPP must be approved prior to the start of any work. Additional information related to QA requirements can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf

Yes Does this extramural action involve the collection, generation, use, and/or reporting of environmental data; the design, construction, and operation of environmental technologies; or development of software, models, or methods?

(If "No" then skip to Section IV, and sign the form.)

No Will the SOW or any subsequent work assignments or task orders involve any cross-organizational efforts within EPA?

No	Has a QAPP already been approved for the activities specified in the SOW?
No	Is an applicable QAPP in the process of being prepared, revised, or approved by EPA personnel for future use by the contractor? (QA approval must be obtained before the contractor can start work.)

III QA DOCUMENTATION OPTIONS

All documentation specified under "Other" must be defined in the NHSRC Quality Management Plan and be consistent with requirements defined in EPA Manual 5360 A1. For all items checked below, there must be adequate information in the SOW (or its appendices) for the offeror to develop this documentation. Where applicable, reference a specific section of the SOW. *(R-2 refers to EPA Requirements for Quality Management Plans (QA/R-2) (EPA/240/B-01/002, 03/20/01) and R-5 refers to EPA Requirements for Quality Assurance Project Plans (QA/R-5) (EPA/240/B-01/003, 03/20/01). Copies of these documents are available at http://www.epa.gov/quality/qa_docs.html.)*

After Award Documentation

Not Applicable	Documentation of an organization's Quality System. QMP developed in accordance with:
Not Applicable	Combined documentation of an organization's Quality System and application of QA and QC to the single project covered by the contract: Developed in accordance with:
Other	Documentation of the application of QA and QC activities to applicable project(s). Developed in accordance with: Explain: The QAPPs shall be developed in accordance with the attachment #1 (QAPP requirements for applied research projects)
n/a	Programmatic QA Project Plan with supplements for each specific project, developed in accordance with:
Not Applicable	Existing documentation of the application of QA and QC activities will be used:

IV SIGNATURE BLOCK

The signatures below verify that the Statement of Work (SOW) has been reviewed to ascertain the necessary QA and QC activities required to comply with EPA Order 5360.1 A2, that the COR understands these requirements, and that the COR will ensure that the quality requirements indicated on the previous pages of this form are incorporated into all associated SOWs. *(Sign/date below, obtain a concurrence signature from the QA Staff, and submit the form along with the other extramural action documentation.)*

Sangdon Lee NHSRC-DCMD Technical Lead Person	10/17/2011 Date	Ramona Sherman NHSRC-IO QA Staff Member	11/09/2011 Date

QAPP REQUIREMENTS FOR APPLIED RESEARCH PROJECTS

(from Appendix B of the NHSRC QMP)

An applied research project is a study to demonstrate the performance of technologies under defined conditions. These studies are often pilot- or field-scale. The following requirements should be addressed as applicable.

SECTION 0.0, APPROVAL BY PROJECT PARTICIPANTS

page of the QA plan, documenting agreement to project objectives and the approach for evaluating these objectives.

A distribution list shall be provided to facilitate the distribution of the most recent current version of the QAPP to all the principal project participants.

SECTION 1.0, PROJECT DESCRIPTION AND OBJECTIVES

1.1 The purpose of study shall be clearly stated.

1.2 The process, site, facility, and/or environmental system to be tested shall be described.

1.3 Project objectives shall be clearly stated and identified as primary or non-primary.

SECTION 2.0, PROJECT ORGANIZATION

2.1 Key points of contact for each organization involved in the project shall be identified.

2.2 All QA Managers and their relationship in the organizations (*i.e.*, location within each organization) shall be identified with evidence that the QA Manager is independent of project management.

2.3 Responsibilities of all other project participants and their relationship to other project participants shall be identified meaning that organizations responsible for planning, coordination, sample collection, sample custody, measurements (*i.e.*, analytical, physical, and process), data reduction, data validation, and report preparation shall be clearly identified.

SECTION 3.0, EXPERIMENTAL APPROACH

3.1 The general approach and the test conditions for each experimental phase shall be provided. The statistical methods that will be used to evaluate the data (*i.e.*, ANOVA, or summary statistics) should be identified.

(NOTE: As deemed appropriate to the project by the TLP, the information requested in Sections 3.2, 3.3, and 3.4 may be presented here or in Section 4; the information requested in Sections 3.5 may be presented here or in Section 5; and the information requested in Sections 3.6 may be presented here or in Section 7.)

3.2 The sampling strategy shall be included and evidence must be presented to demonstrate that the strategy is appropriate for meeting primary project objectives, *i.e.*, a description of the statistical method or scientific rationale used to select sample sites and number of samples shall be provided.

3.3 Sampling/monitoring points for all measurements (*i.e.*, including locations and access points) shall be identified.

3.4 The frequency of sampling/monitoring events, as well as the numbers for each sample type and/or location shall be provided, including QC and reserve samples.

3.5 All measurements (*i.e.*, analytical [chemical, microbiological, assays], physical, and process) shall be identified for each sample type or process, and project-specific target analytes shall be listed and classified as critical or noncritical in the QAPP.

3.6 The planned approach (statistical and/or non-statistical) for evaluating project objectives shall be included.

SECTION 4.0, SAMPLING PROCEDURES

4.1 Whenever applicable, the method used to establish steady-state conditions shall be described.

4.2 Known site_specific factors that may affect sampling/monitoring procedures shall be described.

4.3 Any site preparation needed prior to sampling/monitoring shall be described.

4.4 Each sampling/monitoring procedure to be used shall be discussed or referenced. If compositing or splitting samples, those procedures shall be described.

4.5 For samples requiring a split sample for either QA/QC purposes or for shipment to a different laboratory, the QAPP shall identify who is responsible for splitting samples, and where the splitting is performed (*e.g.*, field versus lab).

4.6 If sampling/monitoring equipment is used to collect critical measurement data (*i.e.*, used to calculate the final concentration of a critical parameter), the QAPP shall describe how the sampling equipment is calibrated, the frequency at which it is calibrated, and the acceptance criteria for calibration or calibration verification, as appropriate.

4.7 If sampling/monitoring equipment is used to collect critical measurement data, the QAPP shall describe how cross-contamination between samples is avoided.

4.8 The QAPP shall include a discussion of the procedures to be used to assure that representative samples are collected.

4.9 A list of sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis, shall be specified.

4.10 Containers used for sample collection, transport, and storage for each sample type shall be described.

4.11 Describe how samples are uniquely identified.

4.12 Sample preservation methods (*e.g.*, refrigeration, acidification, *etc.*), including specific reagents, equipment, and supplies required for sample preservation shall be described.

4.13 Holding time requirements shall be noted.

4.14 Procedures for packing and shipping samples shall be described.

4.15 Procedures to maintain chain_of_custody (*e.g.*, custody seals, records) during transfer from the field to the laboratory, in the laboratory, and among contractors and subcontractors shall be described to ensure that sample integrity is maintained.

4.16 Sample archival requirements for each relevant organization shall be provided.

SECTION 5.0, TESTING AND MEASUREMENT PROTOCOLS

5.1 Each measurement method to be used shall be described in detail or referenced. Modifications to EPA_approved or similarly validated methods shall be specified.

5.2 For unproven methods, verification data applicable to expected matrices shall be included in the QAPP meaning the QAPP shall provide evidence that the proposed method is capable of achieving the desired performance.

5.3 For measurements which require a calibrated system, the QAPP shall include specific calibration procedures applicable to each project target analyte, and the procedures for verifying both initial and continuing calibrations (including frequency and acceptance criteria, and corrective actions to be performed if acceptance criteria are not met).

SECTION 6.0, QA/QC CHECKS

6.1 At a minimum, the QAPP shall include quantitative acceptance criteria for QA objectives associated with accuracy, precision, detection limits, and completeness for critical measurements (process, physical, and analytical, as applicable) for each matrix.

6.2 Any additional project-specific QA objectives shall be presented, including acceptance criteria. This includes items such as mass balance requirements.

6.3 The specific procedures used to assess all identified QA objectives shall be fully described.

6.4 The QAPP shall list and define all other QC checks and/or procedures (*e.g.*, blanks, surrogates, controls, *etc.*) used for the project, both field and laboratory.

6.5 For each specified QC check or procedure, required frequencies, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met shall be included.

SECTION 7.0, DATA REPORTING , DATA REDUCTION , AND DATA VALIDATION

7.1 The reporting requirements (*e.g.*, units, reporting method [wet or dry]) for each measurement and matrix shall be identified.

7.2 The deliverables expected from each organization responsible for field and laboratory activities shall be listed

7.3 Data reduction procedures specific to the project, and also specific to each organization, shall be summarized.

7.4 Data validation procedures specific to each organization used to ensure the reporting of accurate project data to internal and external clients shall be summarized.

7.5 Data storage requirements for each organization shall be provided.

7.6 The product document that will be prepared for the project shall be specified (*e.g.*, journal article, final report, *etc.*). The contents of this document can be referenced to a NHSRC or program-specific QMP, if appropriate.

SECTION 8.0, ASSESSMENTS

8.1 The QAPP shall identify all scheduled audits (*i.e.*, both technical system audits [TSAs] and performance evaluations [PEs]) to be performed, who will perform these audits, and who will receive the audit reports.

8.2 The QAPP shall provide procedures that are to be followed that will ensure that necessary corrective actions will be performed.

8.3 The responsible party(-ies) for implementing corrective actions shall be identified.

SECTION 9.0, REFERENCES

References shall be provided either in the body of the text as footnotes or in a separate section.

QAPP REQUIREMENTS FOR BASIC RESEARCH PROJECTS
(from Appendix B of the NHSRC QMP)

A basic research project is a study performed to generate data used to evaluate unproven theories, processes, or technologies.

SECTION 1.0, PROJECT OBJECTIVES AND ORGANIZATION

1.1 State the project objectives.

1.2 Identify the responsibilities of all project participants (*e.g*, QAPP preparation, sample collection and analyses, data reduction/validation/analysis, report preparation, QA).

SECTION 2.0, EXPERIMENTAL APPROACH

2.1 Describe the process, site, facility, apparatus, and/or environmental system to be tested.

2.2 Describe all known or pre-established test conditions and variables, including replicate experimental runs.

2.3 Describe the planned approach (statistical and/or non-statistical) for evaluating project objectives (*i.e.*, data analysis).

SECTION 3.0, SAMPLING AND MEASUREMENT APPROACH AND PROCEDURES

3.1 Complete the following table to summarize the sampling strategy to be used.

Sample/Measurement Location	Matrix	Measurement	Frequency	Experimental QC1	Total No. Samples

1QC samples generated during experiment, as applicable (*e.g.*, blanks, replicate samples, spikes)

3.2 Complete the following table to summarize the sampling and analytical procedures to be used.

Matrix	Measurement	Sampling/ Measurement Method1	Analysis Method1	Sample Container/ Quantity of Sample	Preservation/ Storage	Holding Time(s)2

1Provide details in text, as necessary, if standard method or SOP cannot be referenced
2Both to extraction and analysis, if applicable

SECTION 4.0, QA/QC CHECKS

Complete the following table to summarize QA/QC checks.

Matrix	Measurement	QA/QC Check1	Frequency	Acceptance Criteria	Corrective Action

1Include all QA/QC checks (experimental and analytical, as applicable) for accuracy, precision, detection limits, mass balance, *etc.* (*e.g.*, matrix spikes, lab control samples, blanks, replicates, surrogates)

SECTION 5.0, DATA REPORTING

Describe data reduction procedures specific to the project.

SECTION 6.0, REFERENCES

Provide references to methods and germane prior publications.

IN ADDITION , WHEN APPLICABLE ...

- list all project-specific target analytes (*i.e.*, when a class of compounds is specified in the table)
- indicate if reporting is on a wet or dry weight basis (solid matrices only)
- describe the method used to establish steady-state conditions
- describe how sampling equipment is calibrated
- describe how cross-contamination between samples is avoided
- describe the procedures used to collect representative samples
- describe sample packing and shipping procedures
- describe instrument calibration procedures and acceptance criteria if not included in a referenced method or SOP.

Attachment # 2

NHSRC QA
To the Statement of Work
Requirements/Definitions List

EPAs Quality System Website: http://www.epa.gov/quality
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html
EPA's Quality System Website: http://www.epa.gov/quality/qs-docs/r5-final.pdf

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation described herein. All Quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approve the quality documentation. The Quality Assurance Project Plan (QAPP) shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government.

NHSRC's Quality System Specifications for Extramural Actions –

These requirements typically pertain to single project efforts. The five specifications are:

(1) **a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;**
(2) **an organizational chart showing the position of the QA function;**
(3) **delineation of the authority and responsibilities of the QA function;**
(4) **the background and experience of the QA personnel who will be assigned to the project; and**
(5) **the organization's general approach for accomplishing the QA specifications in the SOW.**

NHSRC QA Requirements/Definitions List
Category Level Designations (determines the level of QA required):

☐ **Category I Project** - applicable to studies performed to generate data used for enforcement activities, litigation, or research project involving human subjects. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

☐ **Category II Project** - applicable to studies performed to generate data used in support of the development of environmental regulations or standards. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

☐ **Category III Project** - applicable to projects involving applied research or technology evaluations. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP: QAPP** requirements for the specific project type (see below).

☐ **Category IV Project** - applicable to projects involving basic research or preliminary data gathering activities. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP QAPP** requirements for the specific project type (see below).

Project Types:

These outlines of NHSRC's QAPP Requirements for various project types, from Appendix B of the NHSRC QMP (except where otherwise noted), are condensed from typically applicable sections of R-5 (EPA Requirements for QA Project Plans) and are intended to serve as a starting point when preparing a QAPP. These lists and their format may not fit every research scenario and QAPP's must conform to applicable sections of R-5 in a way that fully describes the research plan and appropriate QA and QC measures to ensure that the data are of adequate quality and quantity to fit their intended purpose.

☐ **Applied Research Project** - pertains to a study performed to generate data to demonstrate the performance of accepted processes or technologies under defined conditions. These studies are often pilot- or field-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Applied Research Projects" from Appendix B of the NHSRC QMP.

☐ **Basic Research Project** - pertains to a study performed to generate data used to evaluate unproven theories, processes, or technologies. These studies are often bench-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Basic Research Projects" from Appendix B of the NHSRC QMP.

☐ **Design, Construction, and/or Operation of Environmental Technology Project** - pertains to environmental technology designed, constructed and/or operated by and/or for EPA. The QAPP shall address requirements in the EPA Quality System document "Guidance on Quality Assurance for Environmental Technology Design, Construction, and Operation" G-11, at http://www.epa.gov/quality/QS-docs/g11-final-05.pdf. For additional information, you may refer to Part C of "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology," ANSI/ASQC E4-1994, American Society for Quality Control, Milwaukee, WI, January 1995.

☐ **Geospatial Data Quality Assurance Project** - pertains to data collection; data processing and analysis; and data validation of geospatial applications. The QAPP shall address requirements in the EPA Quality System document "Guidance for Geospatial Data Quality Assurance Project Plans" G-5S at http://www.epa.gov/quality/QS-docs/g5g-final-05.pdf.

☐ **Method Development Project** - pertains to situations where there is no existing standard method, or a standard method needs to be significantly modified for a specific application. The QAPP shall address all requirements listed in "QAPP Requirements for Method Development Projects" from Appendix B of the NHSRC QMP.

☐ **Model Development Project** - includes all types of mathematical models including static, dynamic, deterministic, stochastic, mechanistic, empirical, etc. The QAPP shall address requirements in the EPA Quality System document "Guidance for Quality Assurance Project Plans for Modeling" G-5M at http://www.epa.gov/quality/QS-docs/g5m-final.pdf.

☐ **Sampling and Analysis Project** - pertains to the collection and analysis of samples with no objectives other than to provide characterization or monitoring information. The QAPP shall address all requirements listed in "QAPP Requirements for Sampling and Analysis Projects" from Appendix B of the NHSRC QMP.

☐ **Secondary Data Project** - pertains to environmental data collected from other sources, by or for EPA, that are used for purposes other than those originally intended. Sources may include: literature, industry surveys, compilations from computerized databases and information systems, and computerized or mathematical models of environmental processes. The QAPP shall address all requirements listed in "QAPP Requirements for Secondary Data Projects" from Appendix B of the NHSRC QMP.

☐ **Software Development and Data Management Project** - pertains to software development, software/hardware systems development, database design and maintenance, data validation and verification systems. The QAPP shall address all requirements listed in "QAPP Requirements for Software Development Projects" from Appendix B of the NHSRC QMP.

Definitions:

Environmental Data - These are any measurement or information that describe environmental processes, location, or conditions; ecological or health effects directly from measurements, produced from software and models, and compiled from other sources such as data bases or the literature. For EPA, environmental data include information collected directly from measurements, produced from software and models, and compiled from other sources such as data bases or literature.

Incremental Funding - Incremental funding is partial funding, no new work.

Quality Assurance (QA) - Quality assurance is a system of management activities to ensure that a process, item, or service is of the type and quality needed by the customer. It deals with setting policy and running an administrative system of management controls that cover planning, implementation, and review of data collection activities and the use of data in decision making. Quality assurance is just one part of a quality system.

Quality Assurance Project Plan (QAPP) - A QAPP is a document that describes the necessary quality assurance, quality control, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. A QAPP documents project-specific information.

Quality Control (QC) - Quality control is a technical function that includes all the scientific precautions, such as calibrations and duplications, which are needed to acquire data of known and adequate quality.

Quality Management Plan (QMP) - A QMP is a document that describes an organization's/program's quality system in terms of the organizational structure, policy and procedures, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, documenting, and assessing all activities conducted. A QMP documents the overall organization/program, and is primarily applicable to multi-year, multi-project efforts. An organization's/program's QMP shall address all elements listed in the "Requirements for Quality Management Plans" in Appendix B of the NHSRC QMP.

Quality System - A quality system is the means by which an organization manages its quality aspects in a systematic, organized manner and provides a framework for planning, implementing, and assessing work performed by an organization and for carrying out required quality assurance and quality control activities.

R-2. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001 http://www.epa.gov/quality/QS-docs/r2-final.pdf.

R-5. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001 http://www.epa.gov/quality/QS-docs/r5-final.pdf.

Substantive Change - Substantive change is any change in an activity that may alter the quality of data being used, generated, or gathered.

Technical Lead Person (TLP) - This person is technically responsible for the project. For extramural contract work, the TLP is typically the contracting officer's representative (COR). For intramural work, the TLP is typically the Principal Investigator.

Abbreviations:

COR	Contracting Officer's Representative	IAG	Interagency Agreement
NHSRC	National Homeland Security Research Center	QA	Quality Assurance
NRMRL	National Risk Management Research Laboratory	QAM	Quality Assurance Manager
QA ID	Quality Assurance Identification	QMP	Quality Management Plan
QAPP	Quality Assurance Project Plan	SOW	Statement of Work
QS	Quality System	CRADA	Cooperative Research & Development Agreement
TLP	Technical Lead Person		

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-30

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2012 Base Option Period Number 2	

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 10/06/2011 To 03/31/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2): ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2012 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Richard Baldauf (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-4386 FAX Number:
Project Officer Name: Larry Farmer (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3104 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Renita Tyus Renita Tyus (Signature) 10/6/11 (Date)	Branch/Mail Code: CPOD Phone Number: 513-487-2094 FAX Number: 513-487-2109

Performance Work Statement
Contract EP-C-09-027
Work Assignment 2-30

Title

Biodiesel Speciated Fuel and Temperature Effects in Heavy-Duty Diesel Engines

Description

Generate cold temperature emissions data from Light (8,500 GVWR < LHDDE<19,500 GVWR) and Medium (19,500 GVWR<MHDDE< 33,000 GVWR) Heavy Duty Diesel Engines (per the Emission Standards Reference Guide for Heavy-Duty and Nonroad Engines). At least one vehicle will be tested on both the heavy-duty chassis dynamometer and the light-duty chassis dynamometer. Driving cycles will consist of up to five heavy- or medium-heavy-duty cycles including the Heavy-Duty Urban Dynamometer Driving Schedule (http://www.epa.gov/otaq/emisslab/methods/huddscol.txt).

Background

This project directly addresses the air, climate, and human health program areas, and supports the other motor vehicle as well as the biodiesel biofuels initiative projects. The 2007 Diesel Highway Rule (40 CFR Parts 69, 80, and 86), phased in new emissions standards requiring 100% compliance in 2010. While the two currently regulated "critical pollutants", particulate matter (0.01 grams per brake-horsepower-hour (g/bhp-hr)) and NO_x (0.20 g/bhp-hr) impact air quality and related health issues, proposed new rules focus on two related areas with broader environmental and social effects: truck fuel economy and greenhouse gas (GHG) emissions. The two go hand-in-hand because burning carbon-based petroleum fuels creates carbon emissions, so improving fuel economy directly lowers an internal combustion engine's main GHG, carbon dioxide (CO_2).

Scheduled to be phased in between 2014 and 2018, new truck rules are part of an overall energy strategy that looks to reduce U.S. dependency on foreign energy supplies and lower CO_2 creation to address global warming concerns. It is estimated that commercial trucks consume more than 2-million barrels of oil every day and account for 20% of transportation-related GHGs. For example, the state of California estimates that diesel trucks are responsible for seven and a half percent of all of California's global warming pollution.

The call for truck rules does not come with specific target numbers, but requires EPA, with the aid of the National Highway Transportation Safety Administration (NHTSA) to set standards based on research data. Much of the guidance for determining the standards will come from a congressionally mandated report. Created under the auspices of the National Research Council (NRC), "Technologies and Approaches Reducing the Fuel Consumption of Medium- and Heavy-Duty Vehicles" was put together by a 19-member panel that combined academic researchers,

engineers, and technologists with backgrounds in truck and component manufacturing.

Diesel PM consists of three primary constituents: elemental carbon particles from incomplete combustion, which make up the largest portion of the total PM; the soluble organic fraction (SOF), which consists of unburned hydrocarbons that have condensed into liquid droplets or have adsorbed onto the surfaces of the elemental carbon particles; and sulfates with associated water, which result from oxidation of fuel-borne sulfur in the engine's exhaust.

Several exhaust emission control devices have been developed to control diesel PM constituents – the diesel oxidation catalyst (DOC), and the many forms of PM filters, catalyzed diesel particulate filters (CDPFs), or PM traps. DOCs have been shown to be durable in use, but they effectively control only the soluble organic fraction (SOF) portion of the total PM which, especially on today's engines, constitutes only around 10 to 30 percent of the total PM. Therefore, the DOC alone is not capable of meeting the FTP 0.01 g/bhp-hr PM standard set in the 2007 Diesel Highway Rule.

This study will focus on the effects to emissions from the use of biodiesel blend (B20 – ASTM D7467) fuel in on-road vehicles. The use of biodiesel in fuel has increased nearly three-fold since 2005, according to the National Biodiesel Board. The use of biodiesel increases the minimum usable (cloud point, pour point, and cold filter plugging point) temperature by as much as 10 degrees Fahrenheit without the use of additives. Cold temperature testing will take place at 20 degrees Fahrenheit.

For these reasons, this study will focus on the use of B20 in vehicles fitted with diesel particulate traps to mitigate the emission of elemental carbon particles. The baseline fuel will be ultra-low-sulfur diesel fuel (ULSD) conforming to 40 *Code of Federal Regulations* 86.1313-2007.

The US EPA Heavy-Duty Highway Rule applies to vehicles manufactured in 2007 and beyond. It also limits fuel to less than 15 ppm of sulfur. While heavy-duty vehicles only make up $1/10^{th}$ the VOC emissions of light-duty vehicles and roughly 6% of the CO emissions, they contribute nearly the same amount of NO_x, and 1.5 times the $PM_{2.5}$. Hydrocarbon (HC) emissions are composed of hundreds of compounds, some of which have been identified by the EPA as air toxics. The Clean Air Act directs EPA to set standards to reduce air toxics emissions. For this reason, both regulated emissions and a subset of speciated emissions will be measured and reported.

For heavy-duty diesel engines of model year 2010 and later, certification testing is to be performed in conformance with 40 CFR 1065. This study will use vehicles of MY 2010 or later and therefore testing will conform to 40 CFR 1065 (exceptions to be noted in the Quality Assurance Project Plan).

Scope and Objectives

This Work Assignment (WA) has been designed to fill significant data gaps on temperature and fuel effects for biodiesel blend fuels in vehicles fitted with particulate traps:

- Test cycles will include the CARB MHDT three-mode test, preceded by a cold start Lower Speed Transient Mode (MHDTLO), and followed by the Federal Urban Dynamometer Driving Schedule (UDDS).
- Testing will be conducted at 20°F (-6.7°C) and 75°F (23.9°C) on two vehicles under both laden (100% GVWR) and unladen (50% GVWR) conditions.
- Core measurements will include Total hydrocarbon (THC), non-methane hydrocarbons (NMHC), non-methane organic gas (NMOG), oxides of nitrogen (NOx), nitrogen dioxide (NO2), carbon monoxide (CO), carbon dioxide (CO2) and particulate matter (PM)
- This program shall also generate speciated volatile organic compound (speciated VOC) data. VOC compounds of interest include C1 – C12 hydrocarbons as well as light alcohols and carbonyls.

The contractor shall perform vehicle preparation and driving tests to generate analytical data on exhaust gas emissions. The contractor shall also generate electronic reports and databases, as well as quality assurance documentation.

Work Requirements

The contractor will supply two (2) vehicles for cold testing in triplicate. At least one vehicle will be an MHDDT. The remaining vehicle may be a LHDDT. Only one vehicle will be permitted to have a laden inertial weight in excess of the capacity of the light-duty dynamometer. The contractor will also supply two representative winter blend fuels. One of these winter fuels will be B20. The other will be ULSD. The contractor will supply two representative summer blend fuels. One of these summer fuels will be B20. The other will be ULSD. The contractor will supply all other testing supplies required unless EPA approves exceptions.

The contractor shall be responsible for providing engineering, technical, and Quality Assurance (QA) support for this project. Engineering support includes facility design, test plan development, and general oversight of data collection activities. Technical support includes installing and maintaining all instrumentation and support equipment, as well as calibration, testing, and data processing activities. QA support includes reviewing existing standard operating procedures (SOPs), preparing QA documentation, developing miscellaneous operating procedures (MOPs), and reviewing raw and processed data prior to delivery to EPA.

Task 1 Work Plan Development

The contractor shall submit a detailed work plan to the EPA for approval. The work plan shall include a detailed description of how the tasks described below are to be performed, including details such as toxics measurement methodology. The work plan shall include suggested alternatives for any of the required tests or procedures if such alternatives are thought to result in higher quality results.

The project work plan shall include descriptions of each task to be accomplished, along with detail on the level of effort, by professional grade, a cost breakdown for each task, and any information on the underlying assumptions used in arriving at these cost estimates. The contractor

shall conduct necessary activities to properly and efficiently manage the work assignment, including at least weekly communication with the EPA WAM. The contractor shall also include a list of any facility issues or upgrades that may be needed to implement this work assignment. These may include:

-Larger diameter exhaust transfer tube for the light-duty dynamometer
-Exhaust transfer tubes for the heavy-duty dynamometer
-Secondary dilution for the light-duty dynamometer
-Tunnel cleaning to return the light-duty dynamometer to a condition suitable for light-duty spark ignition (SI) testing
-Replacement filters for biodiesel conditioning
-Higher rate of sample train replacement filters
-Reconditioning of two sample pumps
-ECM monitoring software compatible with the selected vehicles
-Fuel storage and/or disposal
-Sample apparatus for PUFs
-Modify the blower control for the light-duty dynamometer CVS to allow for manually switching it on and off
-Vehicle restraint for heavy-duty vehicles without a fifth-wheel

Task 2 Quality-Assurance Project Plan

The contractor shall submit a Quality Assurance Project Plan (QAPP) to the EPA Work Assignment Manager (WAM) for approval. The plan shall detail sample data collection and analysis tasks and procedures for the proposed study. The contractor shall describe measures designed to ensure data quality, including but not limited to:

- Standard operating procedures for equipment used to perform calibrations.
- Calibration frequency and schedule for all equipment used in testing (analyzers, dynamometer, chemical speciation equipment).
- Procedures for data transfer, entry and management.
- Procedures for regular transfer of all data generated in this project to the EPA Work Assignment Manager for review/audit, consistent with Task 6.4 of this Statement of Work.

The QAPP documents shall conform to the EPA ANSI/ASQC E-4 standard and shall include appendices containing all applicable standard operating procedures (SOPs). Guidance for QAPP preparation is available at http://www.epa.gov/quality/qapps.html. The QAPP documents shall conform to SOW Attachment # 1.

Task 3 Test Fuels and Lubricants

The contractor will also supply two representative winter blend fuels. One of these winter fuels will be biodiesel blend B20 – ASTM D7467. The other will be a winter blend of ULSD (conforming with the Highway Diesel Rule, referred to as the "2007 Highway Rule"). The contractor will supply two representative summer blend fuels. One of these summer fuels will be biodiesel blend B20 – ASTM D7467. The other will be a summer blend of ULSD (conforming with the Highway Diesel Rule). Ideally, the base fuel for the B20 will be similar to the ULSD and the winter blend will be as similar to the summer blend as practical while maintaining drivability at 20°F (-6.7°C).

The test fuels must be submitted for speciation both before and after the completion of vehicle testing. The lubricants must be submitted for speciation prior to the inception of vehicle testing. The contractor shall submit a proposed standard for both the fuel and oil analyses for approval by the Work Assignment Manager (WAM).

Task 4 Vehicle Procurement and Preparation

The contractor shall procure two vehicles for testing. Each vehicle must be from either the Light (8,500 GVWR < LHDDE<19,500 GVWR) or Medium (19,500 GVWR<MHDDE< 33,000 GVWR) Heavy Duty Diesel Truck categories. At least one of the two vehicles will be a Medium Heavy Duty Diesel Truck (MHDDT). The GVWR of both vehicles must be such that they can be tested unladen on the light-duty dynamometer. One of the two vehicles must be light enough to test laden on the light-duty dynamometer. Both vehicles must be MY2010 or newer.

The two vehicles to be tested shall undergo a thorough inspection before beginning the test preparation sequence. This includes inspection of the engine, transmission, axles, exhaust system and tires, and documentation of the ECM status. Photographs of the vehicles' exhaust systems shall be taken and included as part of the progress and final reports. The Contractor shall collect and record vehicle information as described in the Quality Assurance Project Plan (QAPP).

Each vehicle shall then undergo initial crankcase oil, oil filter and air filter replacement. Oil and air filters shall be procured by the contractor according to manufacturer's recommendations. Engine oil recommended in the owner's manual of each vehicle shall be used. The recommended grade of lubricant shall be purchased.

After the last test of each vehicle in the program, the Contractor shall record the lubricant level indicated on the dipstick before collecting a 0.25-quart oil sample for analysis.

If any of the vehicles is equipped with traction control, the contractor shall ensure that the traction control is disabled either through an interior disable button or other method (remove power fuse to anti-lock brake system (ABS), and place a placard in the vehicle indicating the method of disabling traction control if driver input is required. The vehicle shall use a 75°F (23.9°C) road load horsepower setting derived from the coastdown coefficients as proposed by the contractor and approved by EPA. For the purpose of this study, the agreed road load setting shall remain the same for all testing on a given vehicle.

Task 5 Vehicle Testing

5.1 Basic Testing Protocol

The basic testing protocol begins with the a cold start Lower Speed Transient Mode (MHDTLO), followed by the three mode CARB MHDT, and ending with the Federal Urban Dynamometer Driving Schedule (UDDS). This protocol will be conducted in compliance with CFR Part 86 Subpart N and CFR Part 1065. This test sequence will be repeated for each fuel at 20°F (-6.7°C) and 75°F (23.9°C). This test sequence will be performed in both the laden (100 percent GVWR) and unladen (50 percent GVWR) conditions at both temperatures. Each test condition will be run on each vehicle at least three times. A fourth test may be run if necessary as described in 5.1.1. All unladen tests on a given vehicle must be done using the 48-inch single roll electric light-duty chassis dynamometer. The laden tests may be performed on the 72-inch single roll electric heavy-duty chassis dynamometer if the load is in excess of the smaller dynamometer's capacity. The same driver shall also be used for all tests on a given vehicle. The contractor may comment on the feasibility of these requirements and propose additional measures that will reduce test-to-test variability, such as multi-shift testing on fewer chassis dynamometers.

Table 5.1-1 Core Test Matrix

Condition (3 Replicates)	Vehicle	FUELS		CELL TEMP		LOAD CASE		DYNO		TEST CYCLES				
		B20	ULSD	20F	75F	Unladen (50% GVWR)	Laden (90% GVWR)	LD Dyno	HD Dyno *no spec	Cold Start MHDT Lower Trans	MHDT Lower Trans	MHDT Higher Trans	MHDT Cruise	UDDS
						LHDDT-1 ULSD								
1	LHDDT		X		X	X		X		x	x	x	x	x
2	LHDDT		X		X		X	X		x	x	x	x	x
3	LHDDT		X	X		X		X		x	x	x	x	x
4	LHDDT		X	X			X	X		x	x	x	x	x
5	LHDDT		X		X		X		X	x	x	x	x	x
						LHDDT-1 FUEL CHANGE TO B20								
6	LHDDT	X			X	X		X		x	x	x	x	x
7	LHDDT	X			X		X	X		x	x	x	x	x
8	LHDDT	X		X		X		X		x	x	x	x	x
9	LHDDT	X		X			X	X		x	x	x	x	x
10	LHDDT	X			X		X		X	x	x	x	x	x
						MHDDT-1 FUEL CHANGE ULSD								
11	MHDDT		X		X	X		X		x	x	x	x	x
12	MHDDT		X	X		X		X		x	x	x	x	x
13	MHDDT		X		X		X		X	x	x	x	x	x
						MHDDT-1 FUEL CHANGE B20								
14	MHDDT	X			X	X		X		x	x	x	x	x
15	MHDDT	X		X		X		X		x	x	x	x	x
16	MHDDT	X			X		X		X	x	x	x	x	x

LHDDT tested laden and unladen - Diesel -Both temps on LD Dyno then move to HD Dyno test diesel at 75F-Laden only

LHDDT tested laden and unladen - B20 -Both temps on LD Dyno then move to HD Dyno test B20 at 75F-Laden only

MHDDT tested unladen - ULSD -Both temps on LD Dyno then move to HD Dyno test at 75F-Laden only

MHDDT tested unladen - B20 -Both temps on LD Dyno then move to HD Dyno test at 75F-Laden only

NOTES
*Light Heavy Duty Diesel(8,500<LHDDT<19,500)
*Medium Heavy Duty Diesel Truck (19,500<MHDDT<33,000)
*A vehicle in excess of 24,000 GVWR could not be tested on the light-duty dynamometer even in the unladen state

All cycles on the light-duty dyno (36X) will be speciated
All cycles on the heavy-duty dyno (12X) will not be speciated
Speciation will include carbonyls, VOCs, PUFs, quartz filters, FTIR
EEPS on all tests (FTIR TBD)
Aethalometer on all tests
Teflon (gravimetric) filters on all tests
Test1 - 4 Phase MHDT
Test2 - 2 Phase Blank and UDDS (for HDV)

Known required modifications:
-Larger diameter exhaust transfer tube for LD Dyno
-Exhaust transfer tubes for HD Dyno
-Secondary dilution for LD Dyno
-Tunnel cleaning
-Replacement filters for biodiesel conditioning
-Higher rate of sample train replacement filters

For low temperature test, the vehicles will be preconditioned per 40 CFR 86.232-94 prior to testing. This protocol calls for a minimum 12 hour soak with a 20°F (-6.7°C) ±5°F (2.8°C) hourly average for the 20°F (-6.7°C) tests. The test cell temperature may not exceed 25°F or fall below 15°F for more than 3 consecutive minutes during the test (40 CFR 86.230-11 (c)(2)). Humidity shall be maintained 75±5 grains H_2O/lb dry air.

When using the light-duty dynamometer, the emissions to be measured and reported are THC, NMHC (by FID), NMOG, NO_x, NO_2, CO, CO_2, PM. The contractor will provide and use cleaned SUMMA cans to collect sample from which the US EPA will speciate the VOCs (including carbonyls). The contractor shall speciate the oxygenates. The contractor will provide polyurethane foam (PUF) sorbent plugs and collect samples on which the US EPA will conduct PAH analyses.

More specifically, the following exhaust emission measurements shall be made:

1. Bag (phase) level and composite THC, NMHC, NMOG, CO, CO_2, NO_x, NO_2 and PM emissions

2. Bag (phase) level speciated VOCs (including alcohols and carbonyls) for a subset of tests (See Task 5.2, below).

Heavy-duty weighting factors shall be used to calculate composite emissions. In addition, the contractor shall report bag (phase) level and total test cycle work measured at the wheels.

During all emission tests, the contractor shall record the following ECM parameters at the rate of 1 Hz using contractor-supplied data acquisition equipment:

- RPM
- Vehicle speed
- Engine load
- Short term fuel trim-bank 1
- Long term fuel trim-bank 1
- MIL status
- Absolute throttle position
- Engine coolant temperature
- Short term fuel trim-bank 2
- Long term fuel trim-bank 2
- Fuel/air commanded equivalence ratio
- Alcohol fuel percent
- Manifold absolute pressure
- Spark advance
- PID Control Module Voltage
- Air Flow Rate From Mass Air Flow Sensor

The facilities for testing shall meet the requirements of 40 CFR Part 86 Subpart N as they apply to vehicle exhaust testing. THC, NMHC, NMOG, NO_x, NO_2, CO, and CO_2, and PM emissions sampling and measurement shall be conducted as specified in 40 CFR 1065. The minimum detection limit for NO_2, measurements shall be 5 ppb. If some aspect of testing will need to be done in variance to the above specifications the contractor shall describe why that is the case and how it may impact the test results. Variances must be approved by the EPA WAM before testing may begin. NMHC and NMOG emissions shall be determined in accordance with the EPAct NMHC/NMOG calculation protocol previously provided by the EPA.

The contractor shall insure that sample flow proportionality is verified after each emission test. For PM samples, a proportionality statistic shall be calculated. For other emissions, the contractor shall verify that the tunnel flow remained constant during the test. The CVS blower shall be kept on for ½ hour before the first emission test on a given day and continuously between emission tests to ensure tunnel stability.

The contractor shall provide defined and maintained cooling fan placement and flow for each test vehicle on all the tests. The flow of air sweeping the vehicle in the test cell shall be consistent between tests.

The contractor shall identify and report test data from external programs as an additional diagnostic to track changes in the analytical and sampling systems used in this program. The contractor shall recommend sample collection and analytical methods for non-standard emission measurements. These recommendations will take into account analytical detection limits, emission rates expected of 2010 and newer heavy-duty vehicles and the requirement to collect all samples in the course of a single set of the above driving cycles. All sample collection and analytical methods related to non-standard emission measurements must be approved by the EPA.

The contractor shall perform "blank" UDDS tests at one month intervals during this program. These tests will involve running the full test sequence drawing only background air into the sampling system. All sampling systems will be operated and measurements will include:

- Phase level THC, CH_4, CO, NO_x, CO_2, PM, NO_2, VOCs (including alcohols and carbonyls)
- Continuous THC, CH_4, CO, CO2 and NO_x

5.1.1 Fuel Change and Test Execution Sequence

The contractor shall follow the fuel change and test execution sequence described in Table 5.1-2, below making sure that during all refueling events the vehicle shall be parked in the same location, facing the same direction.

The first three emission tests on a given vehicle and fuel combination shall be performed back-to-back. After three tests have been completed and the acquired data has passed all quality control verifications as described in the contractor's QAPP, the need for a fourth test shall be

determined by following the variability criteria shown in Table 5.1-3. Specifically, if the standard estimate of error (SEE) of CO_2, NO_x or THC results from three tests on a given vehicle and fuel combination exceeds the levels shown in Table 5.1-3, the contractor shall proceed with a fourth test and notify the EPA WAM within 24 hours, making available the electronic summary reports of the tests in question. The fourth replicate shall be run the same way as the third. The third and the fourth replicates shall also be done back-to-back.

Table 5.1-2. Fuel Change and Test Execution Sequence

Step	Description
1	Drain vehicle fuel completely via fuel rail whenever possible.
2	Turn vehicle ignition to RUN position for 30 seconds to allow controls to allow fuel level reading to stabilize. Confirm the return of fuel gauge reading to zero.
3	Turn ignition off. Fill fuel tank to 40% with next test fuel in sequence. Fill-up fuel temperature must be less than 50°F.
4	Start vehicle and execute catalyst sulfur removal procedure described in Appendix C of CRC E-60 Program report. Apply side fan cooling to the fuel tank to alleviate the heating effect of the exhaust system. Engine oil temperature in the sump will be measured and recorded during the sulfur removal cycle.
5	Perform four vehicle coastdowns from 70 to 30 mph, with the last two measured. If the difference between the last two coastdown times exceeds 0.5 sec. or their average differs by more than ±7% from the running average for that vehicle, then the vehicle will be checked for any obvious and gross source of change in its mechanical friction.
6	Drain fuel and refill to 40% with test fuel. Fill-up fuel must be less than 50°F.
7*	Drain fuel again and refill to 40% with test fuel. Fill-up fuel must be less than 50°F.
8	Soak vehicle for at least 12 hours to allow fuel temperature to stabilize to the test temperature.
9	Start vehicle and perform three Lower Speed Transient Mode (MHDTLO) cycles. During these prep cycles, apply side fan cooling to the fuel tank to alleviate the heating effect of the exhaust system. Following the first two prep cycles, allow vehicle to idle in park for two minutes, then shut-down the engine for 2-5 minutes. Following the last prep cycle, allow the vehicle to idle for two minutes, then shut down the engine in preparation for the soak.
10	(Reserved)
11	Park vehicle in soak area at proper temperature (20°F (-6.7°C) or 75°F (23.9°C)) for 12-36 hours. During the soak period, maintain the nominal charge of the vehicle's battery using an appropriate charging device.
12	(Reserved)
13	Perform a Lower Speed Transient Mode (MHDTLO), soak 10 minutes, perform the three mode MHDT test, and perform the UDDS emissions test.
14	(Reserved)
15	Park vehicle in soak area of proper temperature for 12-36 hours. During the soak period, maintain the nominal charge of the vehicle's battery using an appropriate charging device.
16	(Reserved)
17	Perform a Lower Speed Transient Mode (MHDTLO), soak 10 minutes, perform the three mode MHDT test, and perform the UDDS emissions test.1.
18	Determine whether third replicate is necessary, based on data variability criteria (see Table 5.1-3).
19	If a third replicate is required, repeat steps 14, 15, 16 and 17. If the third replicate is not required, return to step 1 and proceed with next vehicle in test sequence.

* Step 7 shall be executed for vehicles selected by the EPA WAM following the refueling experiment described in Task 4 Vehicle Preparation.

Table 5.1-3. Variability Criteria for Triplicate Testing

Dilute Gaseous Emission	Criteria for requiring a third test (composite cycle emissions)
CO_2	SEE > 3%
NOx	SEE>10%
THC	SEE>10%

In addition, for each set of emission tests performed on a given vehicle/fuel combination, the contractor shall calculate the difference in cranking time. Should that difference exceed 1 second, the contractor shall notify the EPA WAM and perform a review of both cranking events to determine if an additional replicate test is necessary.

The criteria provided in Table 5.1-3 as well as the cranking time criterion are expected to result in a 5% test replication rate.

5.2 Speciation of Volatile Organic Compounds (VOCs)

VOC speciation shall include C1-C12 hydrocarbons as well as light alcohols, and carbonyls. Sampling and analysis of C2-C12 hydrocarbons shall be done using CARB method 1002/1003, "Procedure for the Determination of C2-C12 Hydrocarbons in Automotive Exhaust Samples by Gas Chromatography". Sampling and analysis of alcohols shall be done using CARB method 1001, "Determination of Alcohols in Automotive Source Samples by Gas Chromatography". Sampling and analysis will be the responsibility of the contractor.

Sampling and analysis of carbonyl compounds shall be done using CARB method 1004, "Determination of Aldehyde and Ketone Compounds in Automotive Source Samples by High Performance Liquid Chromatography". Carbonyl sampling is to be performed by the contractor. Carbonyl analysis will be performed by the EPA.

During the analysis of C2-C4 hydrocarbons, special consideration shall be given to 1,3-butadiene. Because of the instability of 1,3-butadiene the analysis of C2 – C4 hydrocarbon samples collected during phase 1 of the test cycle shall be initiated within one hour of collection. The speciation of C5-C12 hydrocarbon samples collected in phase 1 of the test cycle shall be completed within 4 hours of collection. The time between sample collection and the start of C2-C4 and C5-C12 hydrocarbon analysis shall be reported. VOC sampling is to be performed by the contractor. VOC analysis will be performed by the EPA. The contractor shall work with the chemist to make every effort to complete the analysis of C2-C4 and C5-C12 background hydrocarbon samples on the day they are collected.

Alcohol samples shall be sealed and stored at a temperature below 40°F immediately following collection. The contractor shall make every effort to analyze these samples on the day they are collected, but no later than within six calendar days.

Samples of carbonyl compounds shall be collected in cartridge type samplers. These samples shall be extracted immediately following collection (within 15 minutes) and the extracts sealed and stored immediately at a

temperature below 40°F. The contractor shall make every effort to analyze these extracts on the day they are collected, but no later than within three calendar days. This analysis shall account for the presence of a tautomer of acrolein, acrolein-x in the sample. To this end, the contractor shall establish the location of the acrolein-x peak in the HPLC chromatogram and using the response factors derived from the calibration for acrolein, quantify and report acrolein-x mass emissions.

The contractor shall provide segregated storage for alcohol and carbonyl samples to prevent their contamination.

No more than one vehicle shall be tested per test day, unless the contractor can demonstrate that the total number of vehicles tested on that day and the timing of their tests will not compromise the time limit requirements imposed on sample analyses.

Phase-level NMHC and NMOG shall be calculated for all phases where the required measurements are available (i.e. NMHC, carbonyls, and light alcohol measurements are made). In cases where one or more components of the phase-level NMHC and NMOG calculation is not measured (for example, when alcohols and carbonyls are not measurement in phases 2 and 3 of FTP tests), the contractor shall calculate phase-level NMHC and NMOG mass emissions assuming the missing measurements are below method detection limits. These phase-level NMHC and NMOG calculations shall then be used to calculate composite weighted NMHC and NMOG mass emissions. In all cases, the contractor shall report all measured phase-level NMHC and NMOG components (i.e. each compound quantified) separately along with the associated FID response factors used in NMHC and NMOG determination.

5.3 (Reserved)

5.4 PM measurement and Analysis

PM shall be collected on a Teflon filter and quartz filter for mass determination and subsequent chemical analysis. The sampling method shall allow for the collection of sufficient sample for chemical analyses. PM mass will be measured as specified in 40 CFR Part 1065. Deviations from this method will require approval from EPA.

"Elemental" and "organic" carbon is to be analyzed by the TOT and TOR methods. PM soluble organic fraction (SOF), and sulfates. The method(s) to be used for these analyses shall be defended and explained in detail, along with why that method is preferred over other methods.

Task 6 Coordination and Support of Non-regulated Emissions Measurements

6.1 Laser Instrument

Support Edgar Thompson in the setup and operation for approximately two weeks of using the laser instrument currently in the PT Cruiser. This will include the installation and initial operation of the additional laser calibrated to the measurement of formaldehyde as well as an additional channel to log the output data.

6.2 FTIR
Coordinate with Edgar Thompson as he conducts FTIR measurements from a probe into the dilution tunnel.

6.3 PAH
Coordinate with Michael Hays to provide sufficient media to sample PAH's for 3 of the five sample phases per test.

6.4 VOC
Coordinate with Tom Long or designee to provide sufficient clean and prepared SUMMA cans for VOC analysis for all five sample phases per test.

6.5 Metals
Coordinate with Michael Hays to provide sufficient media for metals analysis on two of the five sample phases per test.

Task 7 Deliverables

7.1 Work Plan

The contractor shall submit a work plan for this Work Assignment.

7.2 Quality-Assurance Project Plan

The contractor shall provide a quality-assurance project plan (see Section 2). Approval of this plan must be received prior to the start of data generation and collection.

7.3 Weekly Reports

The contractor shall provide a weekly contract progress report. This requirement can be met during weekly meetings or telephone conferences.

The oral report shall indicate progress achieved in the preceding week, technical issues encountered, solutions to issues (proposed or attempted), and projected activity in the following week. This report shall include any potential issues or circumstances that arise causing any delays in the testing. The EPA WAM or his/her designated alternate shall participate in these phone conferences.

The contractor shall provide on a weekly basis to the EPA WAM a report summarizing hours and dollars expended on the Tasks in the PWS and the number of valid tests performed. The goal of the report is to identify as early as possible if costs in dollars, and hours are exceeding that which has been budgeted for the program by EPA and scheduled by the contractor. The contractor shall provide biweekly updates on the cost per test to date and alert the EPA WAM if, anytime during this program, the cost per test exceeds the agreed upon amount. In case of such an exceedance, WAM approval will be required to continue the program.

7.4 Weekly Reports

The contractor shall provide monthly progress reports and invoices in accordance with contract. See the Reports of Work, EPAAR clause 1552.211-70, Submission of Invoices, EPAAR clause 1552.232-70.

7.5 Data Files

The contractor shall submit the data to EPA in three formats, each format having different levels of post processing and aggregation. The files are nominally:

1. Non-Post processed data files (raw data): These are the native test level data files, usually generated by instrumentation, that have not been post-processed for such purposes as time-series alignment or calculation of continuous emission rates. They shall be submitted to EPA as a deliverable for this work assignment and labeled using the following convention:

   'e'<*VehID*>_<*fuelID*>_raw.<*extension*>

   where *VehID* is the unique identifier designated for vehicle, *fuelID* is the unique identifier assigned to each fuel type, and *extension* is the appropriate file extension for the file's data format. Modifications to the specified file-naming convention may be adopted following approval from the EPA Work Assignment Manager.

2. Post processed data files: These are the minimally processed test level data files that will contain the composite, test level, bag level, and 1 Hertz (modal) emission rates in the units specified in 40 CFR Part 86. They shall be submitted to EPA as a deliverable for this work assignment and labeled using the following convention:

   'e'<*VehID*>_<*fuelID*>_pst.<*extension*>

   where *VehID* is the unique identifier designated for vehicle, *fuelID* is the unique identifier assigned to each fuel type, and *extension* is the appropriate file extension for the file's data format Modifications to the specified file-naming convention may be adopted following approval from the EPA WAM.

3. The contractor shall also deliver Mobile Source Observation Database (MSOD) input data files containing test results and vehicle information using table names, structures, field names and field formats. During the program it may be necessary to design and apply new data types, tables and structures. As necessary, such modifications to the data structure may be proposed by the contractor and approved by the EPA WAM. The contractor shall inform the EPA WAM if they believe the specified precision for a given field(s) is inadequate or inappropriate. The WAM and the contractor shall then determine what changes in the format may be necessary to accurately store the data for future use in MSOD.

The contractor shall include in the work plan prototype electronic versions of the above three file types for the inspection and approval of the EPA WAM.

7.6 Mode of Delivery

The contractor shall deliver one set of files to the EPA.

The contractor shall deliver the data contained in the MSOD formatted tables via a secure method to be proposed by the contractor and approved by the WAM. Under no circumstances shall the contractor deliver these files by insecure methods such as electronic mail attachments or First Class Mail.

7.7 Draft Final Report

The contractor shall develop a draft final report that details the work completed including any issues encountered and results from Tasks 1 through 7.

The draft report submitted to EPA shall include:

1. Vehicle-related information, VIN, mileage, emission system descriptions, etc.
2. Measurement methodologies and quality measures.
3. Test completion diary for individual vehicles detailing any relevant information regarding completion of each test.
4. All data collected in Tasks 1 through 5 of this work assignment. Graphical displays summarizing the data by fuel type and other relevant breakdowns.
5. Check lists used to control WA specific test protocols.

The draft final report shall be delivered to EPA within six weeks of the testing completion.

7.8 Final Report

The contractor shall provide a final report incorporating EPA comments, within 30 days of receiving comments from EPA. The report shall be in hard copy plus an agreed-upon electronic format. Microsoft Word or Adobe portable document files (*.pdf) are acceptable formats.

Schedule of Deliverables

Steps	Completion Date
Project work plan submission	Within 20 calendar days of receipt of WA
Draft QAPP	Within 10 days of work plan submission
EPA reviews and comments on draft QAPP	Within 15 days of QAPP submission
Final QAPP	Within 15 days of receipt of EPA comments
Emissions Testing	October 15, 2011
Data Delivery	February 27, 2012
Draft Report	TBD
Final Report	TBD

Work Assignment Manager (WAM): Richard Baldauf

ATTACHMENT #1 TO THE STATEMENT OF WORK (SOW) FOR MEASUREMENT PROJECTS

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function;
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function; 07/14/08 A-2
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

□ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X **QAPP Requirements for Measurement Projects**

□ **QAPP Requirements for Secondary Data Projects**

□ **QAPP Requirements for Research Model Development and/or Application Projects**

□ **QAPP Requirements for Software Development Projects**

□ **QAPP Requirements for Method Development Projects**

□ **QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

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NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.
4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.
4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
4.5 Describe the method for uniquely numbering each sample.
4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5 MEASUREMENT PROCEDURES

5.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.
5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6 QUALITY METRICS (QA/QC CHECKS)

6.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.
6.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7 DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.
7.2 Describe data validation procedures used to ensure the reporting of accurate project data.
7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).
7.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.
7.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.
7.4 Describe data storage requirements for both hard copy and electronic data.

8 REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.
8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-35

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2012	Light-Dyno Dilution Tunnel
	Base Option Period Number 2	

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 11/16/2011 To 03/31/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Contract Period:	Cost/Fee:	LOE:
	04/01/2009 To 03/31/2012		
This Action:			
Total:			

Work Plan / Cost Estimate Approvals

Contractor WP Dated:	Cost/Fee:	LOE:
Cumulative Approved:	Cost/Fee:	LOE:

Work Assignment Manager Name: Thomas Long (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3944 FAX Number:
Project Officer Name: Larry Farmer (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3104 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Renita Tyus Renita Tyus (Signature)	11/16/11 (Date)	Branch/Mail Code: CPOD Phone Number: 513-487-2094 FAX Number: 513-487-2109

Statement of Work

Title: Light Duty Dynamometer Dilution Tunnel 1055 Compliance Relocation

WA 2-35

Background

In order to test rear-wheel drive vehicles in the E180 dynamometer facility in compliance with the requirements of 40CFR1065 and 40CFR86 and best practices it is necessary to locate the dilution tunnel from its current position. Currently it flanks the environmental control chamber in which we test vehicles. The current layout permits testing of front wheel drive vehicles only and even then skirts the edge of an acceptable length of transfer tube. The proximity to the vehicle cannot be decreased from the side because the chambers compressors are in the way. A longer transfer tube results in greater tailpipe backpressure which alters vehicle performance. It also results in inconsistent losses (or additions) of particulate matter. Therefore, it is necessary to locate a new dilution tunnel to a position above the chamber as well as provide a cat walk to access the newer tunnel. Depending on the configuration of the test vehicle (front-wheel vs rear-wheel drive) different sections of the dilution tunnel are exchanged with alternate sections. Quality assurance procedures also require access to various ports on the tunnel. This is why a cat walk is necessary on top of the non-load bearing chamber roof. The stainless steel material on the current tunnel is too thick and the inside diameter is too small so existing materials must also be replaced and not re-used.

Tasks

Following is a description of the requirements for the new tunnel. The contractor shall prepare and submit a set of facility layout drawings detailing the layout, materials, and dimensions of the new tunnel and cat walk. Prior to purchase of materials and construction, the WAM must approve the design. The basic configuration of the 8" dilution tunnel that currently flanks the environmental chamber is to be repeated with the newly located 10" ID tunnel on top of the chamber. The wall thickness of the tunnel must be sufficiently thin as to comply with 40CFR1065 and 40CFR86. Materials must also comply with 40CFR1065 and 40CFR86. Use a smooth-walled, electrically conductive tunnel with inside surfaces of 300 series stainless steel. Electrically ground the entire dilution tunnel. A thin walled and insulated dilution tunnel to minimize temperature differences between the wall and the exhaust gases is required. The dilution tunnel must run down the centerline of the chamber roof in order to minimize the distance of the transfer tube from the vehicle exhaust to the dilution tunnel. The tunnel must be as close to the top of the chamber structure as possible but no flange or other portion of the tunnel proper is to be within 1" of the chamber to avoid condensation.

Ports on the new dilution tunnel are to match those on the current 8" tunnel. The primary exceptions are that the transfer tube connection will be for a 4" as opposed to a 3" transfer tube and there will be a 6" sanitary plate near one end for the particulate probes going to the heated filter housing. A spacer that can be exchanged with the transfer tube connection is to be included. Both the spacer and the transfer tube connection should include a lifting eye. There should be an anchor in the ceiling with a lifting eye above each thru-hull. A sling and hoist suitable for lifting will be included. Installation of the transfer tube connectors will include making two penetrations in the roof of the cold chamber. A means of sealing both penetrations will be included. It is also necessary to properly insulate or heat the section of transfer tube within the roof penetration to reduce the likelihood of cold spots.

Three mixing orifices will be provided. The orifices will mate with the tunnel flanges in the same way as is currently in practice on the 8" tunnel. The inside diameters will be 6.5", 7.5" and 8" respectively.

No section of the dilution tunnel may exceed 6' in length or 100 pounds in weight. (This is to facilitate removal for cleaning when changing the fuel types for testing.) Coupling of sections will use sanitary flanges. The HEPA and charcoal filter housing with the tunnel heater on the lab tunnel along the north lab wall and no longer in use may be employed in the construction of the new tunnel. A rolling ladder is

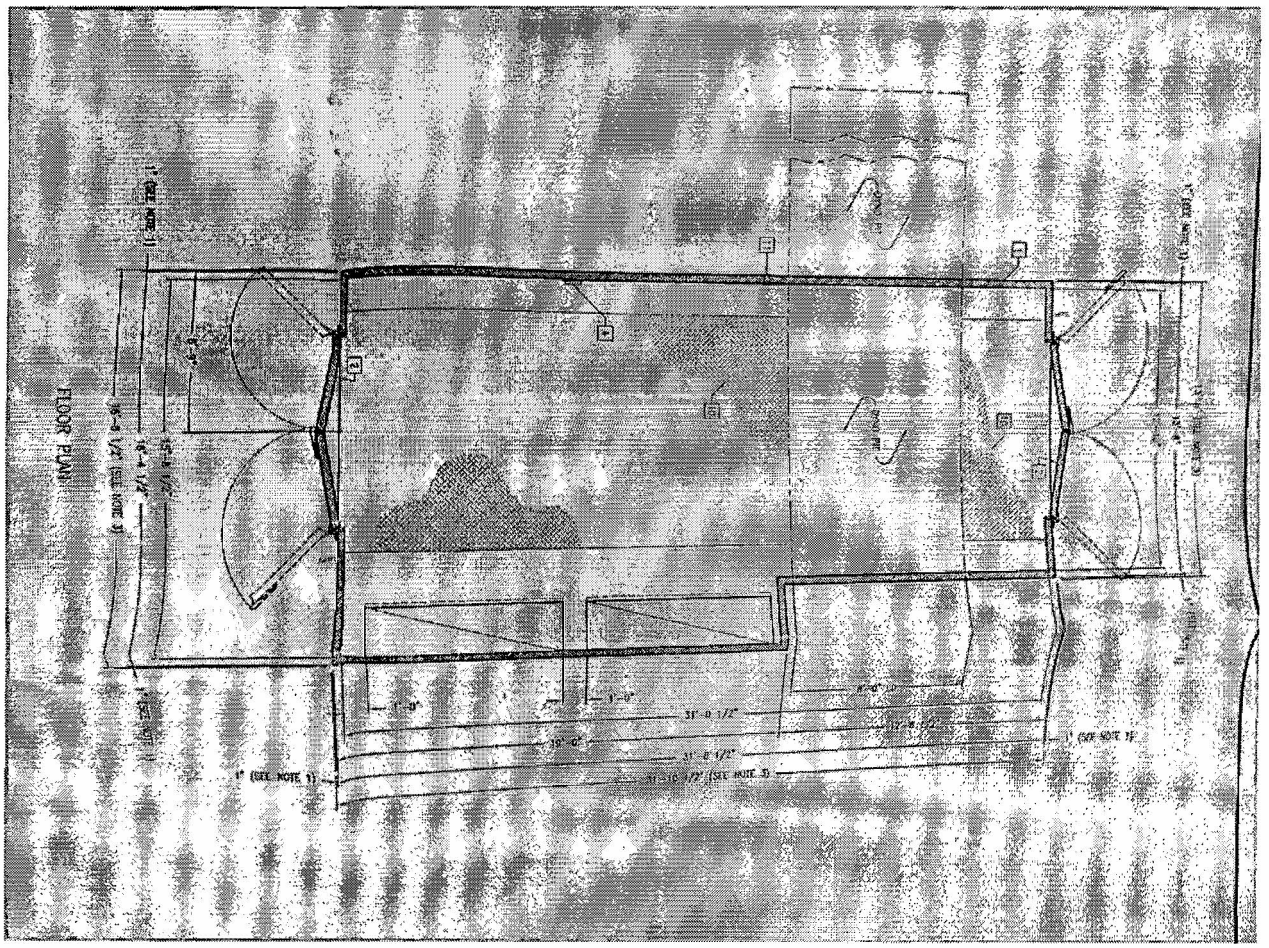
also required for access to the catwalk from the non-mezzanine end. This ladder will have an abrasive mat tread, 12 steps, a platform height of 120", handrail height 30", base width of at least 32", base length of approximately 87", and platform width of at least 24". The materials should be metal. The tread depth should be at least 7". The required load capacity of the ladder should be a minimum of 450 lb.

The new tunnel will merge with the current tunnel in a smooth Y-joint conforming to the above material requirements.

The new transfer tube will be 4" tubing that complies in materials and construction with the requirements of 40CFR1065 and 40CFR86. Use laboratory exhaust tubing materials that are smooth-walled, electrically conductive, and not reactive with exhaust constituents. Stainless steel is an acceptable material. Use laboratory exhaust tubing that has either a wall thickness of less than 2 mm or is air gap-insulated to minimize temperature differences between the wall and the exhaust.

As can be seen in Figure 1, the overall length of the catwalk will be approximately 39'. A 30" width is desired. The catwalk surface should be tread plate. Any 3' section of catwalk should be removable for access underneath the adjacent tunnel. Each of the two 3' sections adjacent to the thru-hulls should have integrated openings for hand grips to lift the plates when changing the spacer and transfer tube connection. The roof of the environmental chamber is non-load bearing and requires a 1" clearance.

Figure 1 - Environmental Chamber Floor Plan



In summary, this request includes the need for the installation of a new dilution tunnel, a new transfer tube, and a new catwalk on top of the existing test chamber roof.

Deliverable	Date
Project Work Plan	Requested by November 25, 2011 (Per the contract Work plan is due within 20 days)
Approval Drawings	December 5, 2011
Start Construction	December 12, 2011
Complete Construction	January 6, 2011

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-37

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2012	Mobile Dev techxfer GAMP REQ
	Base Option Period Number 2	

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 12/01/2011 To 03/31/2012

Comments:

[ ] Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2012 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Eben Thoma (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7969 FAX Number:
Project Officer Name: Larry Farmer (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3104 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Renita Tyus Renita Tyus (Signature) 12/1/11 (Date)	Branch/Mail Code: CPOD Phone Number: 513-487-2094 FAX Number: 513-487-2109

SOW for EP-C-09-027 WA 2-37

Mobile Monitoring Development and Technology Transfer (GAMP REQ DA: IR and UV units)

Background:

This work assignment continues development of NRMRL's Geospatial Monitoring of Air Pollution (GMAP) research program which utilizes next generation, fast response, instruments and precise global positioning systems in mobile platforms to map air pollution patterns around sources and perform emissions characterizations.

Please refer to 1-59, 2-59, and 2-43 for additional background information.

This WA Amendment advances the GMAP platform by adding two new instruments to the system (lower-cost infrared (IR) spectrometer for methane and carbon dioxide and compact ultraviolet (UV) spectrometer for benzene, toluene, ethylbenzene, and xylenes [BTEX]). The modified system will be useful for measurements such as locating and remotely estimating emissions of methane and VOCs from oil and gas production activities and drive-by inspection / remote emissions estimation of industrial facilities such as refineries with potential BETX emissions.

Description of Tasks:

Task 1. Test new concentration measurement instruments provided by EPA

The contractor shall develop quality assurance documentation as required in Attachment #1 to this Statement of Work. Work involving environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Region 5 Quality Assurance Staff. The QAPP shall be a Category III level and must include all necessary elements as described in the Attachment.

Deliverable 1: The QAPP shall be completed and approved by ORD QA staff within 60 calendar days of equipment transfer to the contactor.

Under the technical direction of the WA manager and as per approved QAPP, the contractor shall test and document the performance of the provided IR and UV measurement systems for the measurable compounds (CH_4 and CO_2, for the IR system, and BETX compounds for the UV system).

Deliverable 2: Short-form report on baseline instrument testing shall be completed and approved by ORD QA Staff within 120 calendar days of equipment transfer to the contactor.

Task 2. System engineering

The contractor shall develop a modular GMAP system including all components and software. The contractor shall test and document performance of the system. The contractor shall update all documentation associated with the GMAP method originating from these design changes. Provided government-furnished equipment shall include the IR spectrometer, the UV spectrometer, the compact met station, the 3-D sonic anemometer, and the high resolution GPS system. The contractor shall:

- Revise design and procure high performance instrument enclosures
- Revise design and procure instrument and equipment shipping containers
- Revise design and procure modular instrument vehicle fixtures
- Revise design and procure lithium polymer-based power system
- Revise design and procure modular mast system
- Revise design and procure in-field calibration system
- Revise design of instrument IO for data acquisition and real-time GIS interface
- Revise design and procure of instrument control system
- Revise design and implement control system software for real-time GIS
- Revise design and procure a remote communication uplink
- Revise design and procure source triangulation system
- Revise design and implement emission estimation software
- Test and document performance of integrated system
- Revise and document GMAP method changes
- Revise and document new engineering package

Deliverable 1: Deliverables under Task 2 shall be due within 60 calendar days of Task 1 completion.

Task 3. GAMP system validation and technology transfer training

Under the technical direction of the WA manager, and as per an approved QAPP amendment produced in this task, the contractor shall execute and document tracer gas release and recovery method validation trials and simultaneously conduct instrument technology transfer training exercises (1 week in duration) for select EPA personnel (TBD) at a location (TBD). All equipment shall be removed from the contract at the successful competition of Task 3.

Deliverable: Task 3 short-form report on testing and training activities shall be completed within 60 days of Task 2 completion.

ATTACHMENT #1
TO THE STATEMENT OF WORK (SOW)

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD:

☐ **NRMRL=s Quality System Specifications:**

(1) a description of the organization=s Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization=s general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

☐ **NRMRL=s Quality System Specifications:**

(1) a description of the organization=s Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization=s general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

☐ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X **QAPP Requirements for Measurement Projects**

☐ **QAPP Requirements for Secondary Data Projects**

☐ **QAPP Requirements for Research Model Development and Application Projects**

☐ **QAPP Requirements for Software Development Projects**

☐ **QAPP Requirements for Method Development Projects**

☐ **QAPP Requirements for Design, Construction, and Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA=s Quality System Website: http://www.epa.gov/quality/
EPA=s Requirements and Guidance Documents:
http://www.epa.gov/quality/qa_docs.html

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS: Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.

4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.
4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
4.5 Describe the method for uniquely numbering each sample.
4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5. MEASUREMENT PROCEDURES

5.1. Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.
5.2. If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6. QUALITY METRICS (QA/QC CHECKS)

6.1. For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.
6.2. Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.
7.2 Describe data validation procedures used to ensure the reporting of accurate project data.
7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).
  7.3.1 If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.
  7.3.2 If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.
7.4 Describe data storage requirements for both hard copy and electronic data.

8. REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-38

☐ Other ☒ Amendment Number: 000002

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2012 Base Option Period Number 2	

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2011 To 03/31/2012

Comments:
Please see the attached revisions to the SOW.

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period	Cost/Fee	LOE
04/01/2009 To 03/31/2012		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee	LOE
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Joe Wood (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-5029 FAX Number: 919-541-0496
Project Officer Name: Diane Pierce (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-2708 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Renita Tyus Renita Tyus (Signature) 2/2/12 (Date)		Branch/Mail Code: C PAD Phone Number: 513-487-2094 FAX Number: 513-487-2109

STATEMENT OF WORK

Chamber Decontamination Studies with Chlorine Dioxide Gas and Fogging Technology

OMIS DCMD
APPCD ON-SITE CONTRACT EP-C-09-027

Note: New items under this Amendment 2 are underlined; see Task 2

I. PERIOD OF PERFORMANCE

The period of performance for this work assignment (WA) shall be from April 1, 2011 to March 31, 2012.

II. SUMMARY OF OBJECTIVES

This work shall involve evaluating the sporicidal efficacy of two fogging technologies and chlorine dioxide (ClO_2) gas at low concentrations but long contact times. All testing in the WA shall be conducted in the COnsequence ManageMent ANd Decontamination Evaluation Room (COMMANDER) chamber located in H130. Tests shall be conducted utilizing various assays to assess efficacy in inactivating bacterial spores (surrogates for *Bacillus anthracis*) on various types of materials.

III. BACKGROUND

For the fogging technology research, work will build upon (but not duplicate) tests conducted under WA 1-38. Regarding tests with ClO_2, although ClO_2 gas is a proven sporicidal fumigant technology at high concentrations, it has not been sufficiently tested at low levels and long contact times. Demonstrating the contact times needed for the lower levels of ClO_2 gas to be effective would allow more contractors to be able to use this technology.

IV. TECHNICAL APPROACH

For the fogging tests, it is expected that the fogger equipment and sporicidal solution used in WA 1-38 shall be used in this WA, as well as a new fogging technology. The tests shall be a continuation of work started under WA 1-38, but shall not duplicate efforts. The ClO_2 tests shall be conducted in COMMANDER. In COMMANDER, decontamination efficacy shall be determined based on inactivation of bacterial spores disseminated into the chamber, as well as inactivation of spores that are inoculated (dry deposition) directly onto coupons and other materials. A QATP for this work shall be developed, but it is expected that the QATP developed for current and previous work assignments involving the use of the COMMANDER chamber shall serve as a starting point and should reduce the effort needed to prepare the QATP. Lastly, this work assignment covers only the efforts related to conducting the decontamination tests. All microbiological preparation and analyses work will be conducted by the on-site Biolab under a separate work assignment on this same contract.

V. AFFORDABILITY

This effort is labor intensive, which is where the bulk of the funding is required. Normal expendable laboratory items are also required for this project.

VI. FACILITIES AND MATERIALS

All tasks described in this SOW shall be performed in-house, at the EPA's Research Triangle Park (RTP) facilities at 109 T.W. Alexander Dr.

VII. TASKS

No work conducted under this WA shall duplicate work conducted under previous work assignments, unless directed by the WA manager (WAM), and in order to troubleshoot problems from previous work and to assess repeatability (precision) of the data gathered previously. All microbiological preparation and analyses work will be conducted by the on-site Biolab under a separate work assignment on this same contract.

The Contractor shall perform the following tasks:

1. Prepare a quality assurance/test plan (QATP), which shall cover the experiments as described in Task 2, 10, 11, and 12 of this SOW. Prepare an amendment to the existing QATP for the experiments outlined in Task 3. The QATP shall be in agreement with the requirements set forth in the Quality Assurance Requirement Form (QARF) and as delineated in "Attachment #1". To the extent feasible, the QATP shall be consistent with and based upon existing QATPs, developed under other similar work assignments from previous or current APPCD contracts.

2. Conduct up to 16 experiments in COMMANDER utilizing the Clordisys ClO_2 gas generator. The ClO_2 gas levels and contact times shall be selected based on the results of testing conducted under WA 1-38. Tests will determine the log reduction in viable bacterial spores utilizing the following approach:
   - Bacterial spores aerosolized into COMMANDER containing coupons and other objects, such as a mock office or home set up. The mock office or home would include such items as a desk, wall(s), chairs, etc.

   In addition to assessing efficacy of the technology, the other purposes of the COMMANDER tests with ClO_2 are to qualitatively assess impact of the fumigation on materials exposed to the ClO_2 gas, and also to determine generation rate requirements for each test. For the latter, total mass of ClO_2 used for each COMMANDER test shall be determined, as well as the generation rate required to maintain the test concentration.

3. Conduct up to 12 experiments in COMMANDER utilizing two fogging technologies. It is expected that for 5-6 of these tests, the fogging equipment and liquid sporicidal chemical utilized in WA 1-38 (Minncare) shall be used in this WA. Additional tests shall be conducted with a different technology (as determined by the WAM). Tests shall determine the log reduction in viable bacterial spores utilizing one or more of the following approaches:
   - 4 foot by 4 foot coupon materials; four different coupon materials.
   - Biological indicators.
   - Bacterial spores aerosolized into an empty COMMANDER.
   - Bacterial spores aerosolized into COMMANDER containing coupons and possibly other objects.

4. Provide general support for maintaining the lab equipment. This support shall include assembly, maintenance, troubleshooting, and configuration support for the any equipment used for testing. Support shall also include the purchase of any expendable materials, with prior approval from the WAM, for use in this project.

5. Report the results of all tests, including data received from the Biolab (work conducted under the Biolab WA, in support of this WA) to the WAM as soon as possible via email and through the use of the DTRL share drive. The WAM shall be notified immediately of any problems encountered in the laboratory or with the results obtained. These data shall include any generated data files (i.e., logged data) properly annotated, reports of the experimental conditions, calibration checks, measured variables, and a listing of the samples awaiting further analysis.

6. Analyze the data per the requirements in the QATP and in consultation with the WAM, and report the results of these analyses as soon as possible via email and through the use of the DTRL share drive. The expected data analyses would be in the form of Excel spreadsheets or other appropriate software.

7. Meet with the WAM at least every week to provide a project status update. The update shall include a synopsis of activities taking place the past week, problems encountered, and work planned for the next week.

8. Update the health and safety research protocols, as needed, as required by the EPA Facility and APPCD safety personnel. Updates to these protocols shall be approved by the EPA WAM and safety personnel prior to the commencement of any testing.

9. Prepare monthly reports to EPA that summarize work activities (accomplished and planned) in this work assignment, including the status of applicable test, QA, and safety plans. The monthly report shall also detail labor costs and ODC charges. The ODC charges shall be documented in the report in a way that the items purchased, vendor, and cost are clearly indicated.

10. For the experiments in Task 2 of this WA, obtain needed building materials, furniture, and office equipment to set up a mock office in COMMANDER. These items shall include, but not be limited to, carpeting, ceiling tile, painted wallboard, office chair, laminated desk top, and filing cabinets. The contractor shall build the mock office space with the materials and furniture obtained, in consultation with the WAM.

11. For the mock office set up and experiments in Task 2, obtain 18 desktop computers. The desktop computers and monitors shall be consistent with those used in previous material compatibility projects conducted under this contract, and include a Dell OptiPlex 780 Desktop Computer, a Dell 15 inch Flat Panel Monitor, a USB keyboard and mouse, and a computer and monitor power cords and connecting analog video cable (SVGA). If the model 780 computer is no longer available an equivalent model shall be selected in consultation with the EPA WAM. All materials and equipment required for this testing shall be procured by the contractor as expendable test materials. Computers and

associated equipment shall be tested in triplicate for five of the 10 tests discussed in Task 2. Three computers shall serve as controls, and not exposed to any ClO_2 fumigation.

12. The contractor shall perform diagnostic testing on all computer equipment, including running the PC Doctor protocol on all computer systems, following fumigation tests. The PC Doctor protocol shall be modified as needed for testing computers procured under Task 11. The PC Doctor diagnostic protocol shall be run post-exposure to the fumigation conditions. PC Doctor assessments shall be made monthly for up to one year following the fumigation event.

VIII. DELIVERABLE SCHEDULE

The following table outlines the expected schedule that the contractor shall meet for the period covered by this SOW. The schedule assumes a start date of April 1, 2011. Dates dependent upon completion of specific tasks shall be updated based on discussions between the contractor WAL and EPA WAM during the development of the test plans to cover the work specified herein.

Suggested Deliverable Schedule

Deliverable	Completion Date
Submit work assignment plan	4/15/11
Submit first draft of test/QA Plan for Task 2 testing	5/15/11
Revise test/QA Plan per WAM comments	2 weeks after comments received
Complete Task 2	3/31/12
Complete Task 3 experiments with Minncare technology	6/1/11
Complete Task 3 experiments with new fog technology	3/31/12
Complete task 4	Ongoing throughout project, but complete by 3/31/12
Complete task 5	Ongoing throughout project, but complete by 3/31/12
Complete task 6	Ongoing throughout project, but complete by 3/31/12
Complete task 7	Ongoing throughout project, but complete by 3/31/12
Complete task 8	Ongoing throughout project, but complete by 3/31/12
Complete task 9	Ongoing throughout project, but complete by 3/31/12
Complete task 10	complete by 10/31/11
Complete task 11	complete by 10/31/11
Complete task 12	Ongoing throughout project, but complete

	by 3/31/12

IX. REPORTING REQUIREMENTS

- The Contractor shall prepare a brief memorandum to the WAM which discusses how well various measurements described in the QA plan were met. This is due by 3/15/12.

- The monthly invoice reports for this work assignment shall provide a detailed description of any equipment or expendables that have been purchased by the contractor for use on the projects discussed herein.

- All data and analyses worksheets generated as discussed in Section VII. shall be provided in electronic format in Excel and/or other appropriate software, in consultation with the WAM.

X. QUALITY ASSURANCE

The contractor shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action, see attachment #1 and #2. The contractor shall prepare a QAPP in accordance with http://www.epa.gov/quality/qs-docs/r5-final.pdf or based on the type of research that is being conducted. For guidance on preparing a research-specific QAPP, the preparer should refer to the project specific requirements provided in NHSRC's QMP. The QAPP must be approved prior to the start of any laboratory work. Additional information related to QA requirements can be found at www.epa.gov/quality.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-42

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2012	Oxy-Coal
	Base Option Period Number 2	

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2011 To 03/31/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2): ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2012 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Chun-Wai Lee (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7663 FAX Number:
Project Officer Name: Larry Farmer (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3104 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Renita Tyus Renita Tyus (Signature) 11/8/11 (Date)	Branch/Mail Code: CPOD Phone Number: 513-487-2094 FAX Number: 513-487-2109

Statement of Work
For WA 2-42 Amendment No. 1

Characterization and Control of Emissions from Oxy-Coal Combustion

This work assignment is amended for adding a new task: Effect of oxygen enriched combustion on VOC emissions

The contractor shall operate the IFR under oxy-natural gas firing mode for evaluating the effect of oxygen enriched natural gas combustion on emissions of volatile organic compounds (VOCs). The objective of the added task is to characterize VOC emissions from oxy-natural gas combustion under different IFR furnace operating conditions. The contractor shall provide support and expertise for sampling VOC emissions using the SUMMA canisters. The VOCs samples contained in the canisters will be analyzed using gas chromatography coupled with mass spectrometry (GC/MS) by the existing organic lab set up in the Emissions Characterization & Prevention Branch (ECPB) for measuring VOC emissions from different combustion sources. The contractor shall also provide support and expertise in vapor-phase sampling. This shall include, but not be limited to CO_2, CO, O_2, SO_2, NO_x and total hydrocarbon (THC) measurements taken with continuous emission monitors (CEMs). The contractor shall also provide support and expertise on sampling and characterization of other pollutants such as organic HAPs.

The current QAPP shall be updated by the contractor for this particular Task. The contractor shall not begin data collection until the updated QAPP is approved by EPA Quality Assurance Staff.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-43

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2012 Base Option Period Number 2	Upstream Oil and Gas Emissions

Contractor	Specify Section and paragraph of Contract SOW
ARCADIS U.S., INC.	Section 7.0

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2011 To 03/31/2012

Comments:
Amendment 1 to WA 2-43 to add Tasks 10 and 11

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): 26

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Contract Period: 04/01/2009 To 03/31/2012	Cost/Fee:	LOE:
This Action:			
Total:			

Work Plan / Cost Estimate Approvals

Contractor WP Dated:	Cost/Fee:	LOE:
Cumulative Approved:	Cost/Fee:	LOE:

Work Assignment Manager Name: Eben Thoma (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7969 FAX Number:
Project Officer Name: Larry Farmer (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3104 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Renita Tyus Renita Tyus (Signature) 10/5/11 (Date)	Branch/Mail Code: CPAD Phone Number: 513-487-2094 FAX Number: 513-487-2109

SOW
EP-C-09-027, WA 2-43 Amendment 1 (ver. 09/19/11)

Upstream Oil and Gas Emissions Measurement Project
Well Site Emission Field Studies

This is amendment 1 to work assignment 2-43. Background and description of existing tasks can be found in documentation associated with previous version of this work assignment (WA). This action adds tasks 10 and 11.

Task 10. Development of data visualization and reporting tool:

Under the written technical direction of the WA manager, the contractor shall develop a geospatial mapping-based data visualization and reporting tool to allow efficient review of data produced under previous tasks. The visualization tool shall be based on a LabView™ control for Google Earth™. Both compiled and source code shall be provided. The control system and its operation shall be documented. A QA audit of the performance of the control demonstrating correct file pointing and display shall be provided in the documentation package.

Deliverable: Data visualization tool shall be completed within 60 days of WA amendment initiation.

Task 11. Development of a GMAP-REM-DA-OTM method:

Under the written technical direction of the WA manager, the contractor shall produce a method documentation package for the Geospatial Measurement of Air Pollution - Remote Emission Measurement - Direct Assessment (GMAP-REM-DA) technique developed in previous tasks for location and estimation of emissions from oil and gas production operations. The method documentation package shall be submitted to EPA's Technology Transfer Network, Emissions Measurements Center (EMC) for publication consideration as an "Other Test Method" The OTM method documentation package shall include:

- Measurement method in EMC format
- Operational SOPs
- Engineering design package and equipment build list
- Control and analysis software and source code with description
- Validation and use data to date including a comparison of 10Hz and 0.5 Hz units
- Uses limitations and uncertainties
- In-field and post process method and data quality indicators

The contractor shall confirm the format of the method and supporting documents with the WA manger and EMC personnel before final copy.

Deliverable: Draft test method shall be completed within 120 days of WA amendment initiation.

QA note: There is no collection of environmental data associated with these tasks and the software development is of a trivial nature. Task 10 includes a QA audit of the visualization software. No additional quality assurance plans are required.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-44

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2012 Base Option Period Number 2	Region 2 Port Study

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 12/13/2011 To 03/31/2012

Comments:
Eben Thoma is the alternate WACOR for this WA.

[ ] Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): [ ]

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
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Authorized Work Assignment Ceiling

Contract Period:	Cost/Fee:	LOE:
04/01/2009 To 03/31/2012		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Gayle Hagler (Signature) (Date)	Branch/Mail Code:	
	Phone Number: 919-541-2827	
	FAX Number:	
Project Officer Name: Diane Pierce (Signature) (Date)	Branch/Mail Code:	
	Phone Number:	
	FAX Number:	
Other Agency Official Name (Signature) (Date)	Branch/Mail Code:	
	Phone Number:	
	FAX Number:	
Contracting Official Name: Renita Tyus Renita Tyus (Signature) 12/13/11 (Date)	Branch/Mail Code: CPOD	
	Phone Number: 513-487-2094	
	FAX Number: 513-487-2109	

Work Assignment Form. (WebForms v1.0)

Statement of Work

Air Monitoring Station for Region 2 Port Study

1.0 Background:

EPA ORD, with EPA Region 2, are continuing research to understand the near-field effects of major transit source emissions and are interested in evaluating whether emissions improvements lead to detectable local air quality benefits. The Port of New York / New Jersey (Port Elizabeth) is a key area of interest to Region 2, as voluntary emissions reduction measures such as transitioning to lower sulfur fuel and cleaner newer trucks may relate to improved local air quality over time.

As Port Elizabeth is located in very close proximity to other major sources, including a major highway and an airport, a novel monitoring/modeling strategy will be employed to associate local air pollution to the various sources in the area. This strategy includes high time resolution (nominally, 1 minute data) measurements of pollutants of interest and meteorology over a time horizon adequate to observe gradual changes in emissions (~2 years). These highly time-resolved data will then be input into the nonparametric trajectory analysis (NTA) model that is capable of estimating near-field areas associated with measured concentrations.

This SOW covers the critical first piece of this research study – the design and execution of an air monitoring station that meets the project objectives of robust, long-term, and high-time resolution monitoring of air pollution and meteorology.

2.0 Task and Method Overview

These tasks shall include the fabrication and testing of an air monitoring station measuring in real-time meteorology and air pollutants of interest, including fine particulate matter ($PM_{2.5}$), black carbon, sulfur dioxide, nitrogen dioxide, and carbon monoxide. The station shall be configured to minimize site maintenance visits, including an auto-calibration system and remote access ability for periodic instrument performance checks and data downloads. After configuration, the contractor shall transport the air monitoring shelter to the selected field location, complete the installation of the shelter, and provide training to the site operator.

3.0 Description of Tasks:

Task 1. Fabrication of Transportable Air Monitoring Station

Under the technical direction of the WACOR, the contractor shall design and fabricate an air monitoring station to measure $PM_{2.5}$, black carbon, sulfur dioxide, nitrogen dioxide, carbon monoxide, and meteorology (wind speed and direction, temperature, humidity) continuously with data reporting at a nominal time interval of 1 minute and a maximum time interval of 5 minutes. The gas-phase analyzers (sulfur dioxide, carbon monoxide, nitrogen dioxide) shall be equipped with an auto-calibration system capable of

conducting daily zero/span calibrations. The system shall also have the ability to remotely observe instrument performance and download data. The station shall have air conditioning, heating, and dehumidifying to support instrument performance. Finally, the station shall have security protection, including tamper-proof locks on all entrance ways as well as security fencing as required by the sampling site.

Deliverables:

1.1. The contractor shall provide a schematic of the air monitoring station design, including equipment, data logging, environmental conditioning, predeployment system test plan, and safety features for approval by the WACOR within 30 calendar days of WA initiation.

1.2. The contractor shall complete the fabrication of the monitoring station within 45 calendar days of WACOR acceptance of deliverable 1.1.

1.3. The contractor shall deliver a short-form report on predeployment system testing documenting calibration check (flow checks and multi-point calibration checks) for the air monitoring and meteorology instrumentation within 45 calendar days of WACOR acceptance of deliverable 1.1.

Task 2. Development of Operation Protocols

The contractor shall develop Standard Operating Procedures (SOPs) for operating the station equipment, including routine operation of instrumentation, maintenance steps, quality assurance checks, and technical support contacts. In addition, the contract shall develop SOPs for data logging both on-site and through a remote access portal.

Deliverable:

2.1 The contractor shall provide written SOPs to the WA COR prior to the initiation of Task 3.

Task 3. Station Installation

Under the technical direction of the WACOR, the contractor shall plan and execute the transport and installation of the air monitoring station to the sampling site, which will be determined by the WA COR. The contractor shall participate in project planning meetings (approximately 2 one-hour meetings per month) to be familiar with the site selection process. The contractor shall facilitate all elements of installing the sampling site, including electrical power, security fencing, and consumables to support one year of operation. The contractor shall complete flow and calibration checks of the air monitoring equipment after installation. The contractor shall conduct a training session for the local site operator on station operation.

Deliverable:

3.1 The contractor shall deliver a site design plan including power installation and transport costing for approval to the WACOR with 45 calendar days of WA initiation.

3.2 The contractor shall transport, install, and make operational the monitoring station before March 30, 2012. The contractor shall provide documentation of the successful installation through photographs and conduct onsite training on system operations.

3.3 The contractor shall deliver a short-form report on deployed system testing documenting calibration checks (flow checks and multi-point calibration checks) for the air monitoring and meteorology instrumentation within 10 calendar days of site installation completion.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-49

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2012 Base Option Period Number 2	PCB in Caulk

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2011 To 03/31/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
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Authorized Work Assignment Ceiling

	Cost/Fee:	LOE:
Contract Period: 04/01/2009 To 03/31/2012		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Zhishi Guo (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-0185 FAX Number:
Project Officer Name: Larry Farmer (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3104 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Renita Tyus Renita Tyus (Signature)	11/8/11 (Date)	Branch/Mail Code: CPAD Phone Number: 513-487-2094 FAX Number: 513-487-2109

Contract: EP-C-09-27
Option 2
WA 2-49

Amendment 1

Statement of Work

I. Background

Under Work Assignment 2-49, the Contractor is currently providing technical support to the Government in the studies of characterization and mitigation for PCBs in buildings by operating the laboratories for testing and sample analyses. The scope of work for Work Assignment 2-49 consists of four tasks:

Task 1. Analytical support
Task 2. Laboratory support for testing PCB encapsulation methods
Task 3. Laboratory support for testing the NASA method for PCB destruction
Task 4. Laboratory support for PCB source characterization

This amendment provides incremental funding for Tasks 1, 2, and 3.

II. Amendment to Scope of Work

The Contractor shall complete the analyses of all the samples for the encapsulation study by November 30, 2011. The samples shall include: (1) the samples created by ARCADIS, and (2) re-analyses of some of the samples that the commercial analytical laboratory have analyzed but failed to meet all the data quality criteria outlined in SOP 6982 – Using Commercial Analytical Laboratories for Analyzing Samples for PCB Content. As a minimum requirement, one complete set of wipe samples (i.e., samples with the same aging duration for all the encapsulants tested) must be analyzed.

NASA scientists have developed a PCB-destruction method for contaminated building surfaces, known as the Activated Metal Treatment System (AMTS). As part of this project, EPA will evaluate this method for its efficacy and cost effectiveness. Preliminary data suggest that the extraction method used by NASA (i.e., methanol + water) showed poor extraction efficiency for certain types of samples. The Contractor shall repeat the tests for paint, caulk, and concrete and then extract the samples with hexane.

III. Amendment to Deliverables

The Contractor shall submit all the data for Task 2 and 3 by November 30, 2011.

IV. Work Assignment Duration

The period of performance for this work assignment is from the date this Amendment is issued through March 31, 2012.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-50

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2012 Base Option Period Number 2	

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 05/10/2011 To 03/31/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
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Authorized Work Assignment Ceiling

Contract Period:	Cost/Fee:	LOE:
04/01/2009 To 03/31/2012		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Tiffany Yelverton (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-9456 FAX Number:
Project Officer Name: Larry Farmer (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3104 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Renita Tyus Renita Tyus (Signature)	10/18/11 (Date)	Branch/Mail Code: CPOD Phone Number: 513-487-2094 FAX Number: 513-487-2109

STATEMENT OF WORK AMENDMENT

Surrogacy Testing for HAPs on a Pilot-Scale Coal Fired Power Plant

***Amended* Task 2. Conduct Runs According to the QAPP/Test Plan**

Each test "run" shall roughly be one 8-hour day of operation, where roughly 4-hours will be a sampling period. The following day will be allotted for post-operation clean up. The contractor shall be responsible for coal preparation (pulverization, storage, etc.) and preparation of the sampling equipment and glassware for all of the runs; however, the contractor shall not be responsible for day-to-day operation of the MPCRF. The contractor shall, in coordination with the WAM, conduct experimental runs according to the schedule and conditions described in the existing/revised QAPP which includes testing up to four different types of coal and multiple configurations of the available PM, NO_x, HCl, and SO_2 control technology equipment on the MPCRF (as described in the below table).

Projected Conditions for Each Test

Coal Type	PM Control	NOx Control	SO2 Control	Dry Sorbent Injection for HCl Control	Number of Runs
bituminous	ESP	SCR	wet-FGD	N/A	3
bituminous	FF	SCR	wet-FGD	N/A	1
Mine84 bituminous	ESP			Trona	2
PRB	ESP	SCR	wet-FGD	N/A	1
PRB	FF	SCR	wet-FGD	N/A	2
Texas lignite	ESP	SCR	wet-FGD	N/A	1
Texas lignite	FF	SCR	wet-FGD	N/A	1
			Total		11

The contractor shall also support similar surrogate testing conducted under a separate work assignment. This support will likely include organic HAPs (e.g, aromatic VOCs and carbonyls) sampling and analysis. As this support is dependent on the collaborating work

assignment, the actual support required and schedule will be provided in writing by the WAM at a later date. Therefore, while conducting these tests, the contractor shall also be responsible for support of other experimental sampling as described under a second work assignment managed by Jeff Ryan as determined and submitted at a later date.

Deliverables - None

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-53

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2012 Base Option Period Number 2	PM/Air Toxics from Commercial

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2011 To 03/31/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
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Authorized Work Assignment Ceiling

Contract Period: 04/01/2009 To 03/31/2012 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: John Kinsey (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-4121 FAX Number:
Project Officer Name: Larry Farmer (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3104 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Renita Tyus Renita Tyus (Signature) 11/14/11 (Date)	Branch/Mail Code: CPOD Phone Number: 513-487-2094 FAX Number: 513-487-2109

STATEMENT OF WORK
Work Assignment No. 2-53
Amendment 1

Title: PM/Air Toxics from Commercial Aircraft Engines

Work Assignment COR:

John Kinsey
U. S. Environmental Protection Agency
National Risk Management Research Laboratory
NRMRL-APPCD, MD E343-02
Research Triangle Park, NC 27711
(919) 541-4121; Fax (919) 541-0359
E-mail: kinsey.john@epa.gov

Background:

There have been a number of changes since the original Work Assignment was issued. A substantial number of large Other Direct Cost (ODC) items were required for implementation of Task 3 which were not budgeted. The most significant of these items was the rental of the Mini-CAST aerosol generator. Other unexpected major expenses included the repair of the Engine Exhaust Particle Sizer as well as additional mass flow controllers and associated electronics. In this Amendment, the funds expended for these ODCs are being replaced along with the associated labor hours needed for their purchase. In addition, in Task 2, it has been decided not to revise the Alternative Aviation Fuel Experiment (AAFEX) draft technical report but instead to report these findings in the form of a peer-reviewed journal article which was deemed more useful and cost-effective. Finally, Task 3 should now reflect the final data collection, analysis and reporting of the experimental results.

Revised Scope of Work:

The original Scope of Work is hereby modified as follows.

Task 2: The contractor shall provide technical support during the preparation of a peer-reviewed journal article(s) outlining the results of the NASA Alternative Aviation Fuel Experiment (AAFEX) conducted in January and February of 2009. This support shall include responding to quality assurance and peer review comments, as applicable. The contractor shall also provide preparation and production support for the final document, as needed.

Task 3: The contractor shall continue to provide technical support for the EPA/FAA instrument validation study conducted in the High Bay building. This support shall include activities such as final data collection, analysis and reporting based on the testing conducted during the remainder of this calendar year.

Revised Work Schedule:

Task 2:	Complete draft peer-reviewed journal article: March 31, 2012
Task 3:	To be determined based on final test results

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-54

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2012 Base Option Period Number 2	NHEERL-MED Metrology

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 01/03/2012 To 03/31/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
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Authorized Work Assignment Ceiling

	Cost/Fee:	LOE:
Contract Period: 04/01/2009 To 03/31/2012		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Scott Moore (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-5104 FAX Number:
Project Officer Name: Diane Pierce (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-2708 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Renita Tyus Renita Tyus (Signature) 1/3/12 (Date)		Branch/Mail Code: CPOD Phone Number: 513-487-2094 FAX Number: 513-487-2109

SOW FY 2011-2012
Period of Performance: 01/03/2012 – 03/31/2012
Work Assignment Manager (WAM): Scott A. Moore
Work Assignment Title: NHEERL-MED Metrology QA Lab Support
Contract Number: EP-C-09-027
Work Assignment Number: 2-54

Introduction

Good Quality Assurance (QA) practice requires that routine operations in a research facility be conducted according to prescribed procedures and that data be of known and adequate quality. To insure good QA it is necessary that instrumentation be maintained in good working condition and that it be checked regularly to assure that it produces reliable data. The National Health and Environmental Effects Research Laboratory/Mid-Continent Ecology Division (NHEERL-MED) require that QA practices be established and applied to all research measurement efforts. The Metrology Laboratory (MetLab) provides QA assistance to NHEERL-MED researchers by providing the procedures and the standards to calibrate various scientific devices.

I. Goal/Purpose

The objective of this Work Assignment (WA) is to provide support to the MetLab. This is a facility with the capabilities to check (or audit) the calibration of Environmental Protection Agency (EPA) measurement instrumentation. A second objective is to provide support for preparing and verifying Performance Evaluation Audit (PEA) samples. The overall goal is to assure and document that operations performed in EPA facilities produce data will be of a known and adequate quality. This work assignment does not pertain to the calibration of facility devices such as smoke detectors, lights, or any health and safety related devices such as ambient Carbon Monoxide (CO) monitors that alarm strictly for safety reasons because these are not used to produce data for EPA research products.

II. Background Information

Data Uses — Primary users of the products of this WA will be researchers and operators of equipment in EPA/NHEERL/MED facilities. Calibration and PEA results shall be reported in research reports to support or verify findings.

Lab Site — Work area is D360-A, D362, and D364-A in EPA's Research Center in Research Triangle Park, NC.

Experience — Personnel assigned to this WA must be capable of performing the tasks listed in Section III (Tasks), which include electrical work, plumbing, general experience with lab equipment and materials, a familiarity with the calibration of measurement devices, and a fundamental understanding of the principals behind the measurements and

the ability to reduce data and report it according to the International Organization for Standardization ISO 17025 "General Requirements for the Competence of Calibration and Testing Laboratories" (ISO 17025) standard and the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM).

III. Tasks: Metrology Quality Assurance Lab Support for NHEERL-MED

Task 1. Metrology Quality Assurance Lab Support for NHEERL-MED Pipettes

The Contractor shall find a Designated Specialist that can perform pipette calibrations that conform to the NHEERL-MED Calibration SOPs or ISO 17025 and the GUM. All of these devices will be mailed to the Met Lab or Designated Specialist for calibration. NHEERL-MED will need to pack and mail (via any carrier such as UPS, FedEx, USPS or other) all of the devices (i.e. pipettes) to be calibrated to the Contractor or Designated Specialist. NHEERL-MED will be responsible for those shipping charges. The Contractor shall maintain a record and data base of all equipment calibrations and calibration schedules. The following devices from NHEERL-MED will be calibrated by the Metrology Lab:

a) Total of 600 pipettes. NHEERL-MED would like to maintain a schedule of calibrating 150 pipettes (or ¼ of their total volume) every 3 months.

IV. Deliverables (Applies to all Tasks)

The Contractor shall provide the following reports for NHEERL-MED

(1) Monthly reports of the laboratory support activities including the following:
   a) The number of and type of calibrations performed.
   b) Any costs incurred during calibration activities.
   c) Any maintenance activities performed.
   d) Any documentation activities performed.

(2) Special reports as requested via Technical Directive by the WAM.

(3) The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be delivered on time because multiple projects have overloaded the ability of the laboratory, the WAM shall be notified and then written technical direction shall be provided to the contractor for prioritization.

(4) The WAM shall be copied on all correspondence to and from any laboratories and vendors used in the completion of the tasks associated with the projects. Any documents or literature received during any of these correspondences shall also be made available to the WAM.

(5) The contractor shall provide a Calibration Certificate for each device and give it to the Principle Investigator (PI) or to the Contractor Task Lead and keep a copy (either hard copy or electronic) on record.

(6) The contractor shall use formatting of reports that is comparable to historical reporting and electronic files should be compatible with Agency Standard Software, such as MS Excel 2007, MS Word 2007 and Adobe Reader 9.0 or current agency standard software. Hard copies of reports are acceptable; however, electronic copies are encouraged.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-58

☐ Other ☐ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2012 Base Option Period Number 2	Impact of Decontamination Tech

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☐ Work Assignment Amendment
- ☒ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/11/2011 To 03/31/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
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Authorized Work Assignment Ceiling

	Cost/Fee:	LOE:
Contract Period: 04/01/2009 To 03/31/2012	$309,776.00	3624
This Action:	-$8,804.00	-79
Total:	$300,972.00	3545

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated: 08/29/2011	-$8,804.00	-79
Cumulative Approved:	$300,972.00	3,545

Work Assignment Manager Name: Shannon Serre	Branch/Mail Code:
(Signature) (Date)	Phone Number: 919-541-3817
	FAX Number:
Project Officer Name: Larry Farmer	Branch/Mail Code:
(Signature) (Date)	Phone Number: 919-541-3104
	FAX Number:
Other Agency Official Name	Branch/Mail Code:
(Signature) (Date)	Phone Number:
	FAX Number:
Contracting Official Name: Renita Tyus	Branch/Mail Code: CPOD
(Signature): Renita Tyus (Date): 10/19/11	Phone Number: 513-487-2094
	FAX Number: 513-487-2115

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-63

☐ Other ☒ Amendment Number: 000002

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-09-027	04/01/2009 To 03/31/2012 Base Option Period Number 2	Oil and Gas Production Study

Contractor: ARCADIS U.S., INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2011 To 03/31/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
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Authorized Work Assignment Ceiling

Contract Period:	Cost/Fee:	LOE:
04/01/2009 To 03/31/2012		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Eben Thoma (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-7969 FAX Number:
Project Officer Name: Larry Farmer (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-3104 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Renita Tyus Renita Tyus (Signature) 11/22/11 (Date)		Branch/Mail Code: CPAD Phone Number: 513-487-2094 FAX Number: 513-487-2109

SOW for EP-09-027, WA 2-63 Amendment 2

Oil and Gas Production – Condensate & Produced Water Tank Air Emissions Study

Amendment 2: Add Task 4

This amendment to WA 2-63 adds a task to produce an infrared camera database with associated emission information to help in analysis of fugitive leaks from oil and gas production operations. Under the written technical direction of the WAM, the contractor shall compile a database of infrared camera footage and leak emission taken from the following four sources:

- EP-09-027, WA 2-63 (oil and gas tank emissions study)
- EP-09-027, WA 1-43, and 2-43 (oil and gas mobile monitoring studies)
- EP-04-023, WA 4-47 (petrochemical transport barge study)
- City of Ft. Worth gas study (http://fortworthtexas.gov/gaswells/?id=87074)

The database shall have the following elements and characteristics.

- Compatible elements with geospatial display developed in WA 2-43, Task 10.
- A master file of all filenames and data elements linkages in MS Excel format
- Organization and storage of all raw infrared camera video data files
- Production of 10 second edited versions of all infrared camera video data files
- Organization and storage of all 10 second short-form infrared camera video files
- Leak rate estimate and uncertainty for each infrared camera video data file
- Emitted species data for each infrared camera video data file
- Environmental parameters for each infrared camera video data file

The master file of all filenames and data elements shall be sortable and the 10 second short-form infrared camera video files shall be saved in the native editing software format and in the published format chosen to work best with the geospatial display developed under WA 2-43 Task 10. The details of these formats will be determined through technical discussions with the WAM.

QA note: There is no collection of environmental data associated with this task and the software and database use and development is of a trivial nature. No additional quality assurance plans are required but a 10% auditing of filenames and data elements linkages is planned.

ATTACHMENT #1
TO THE STATEMENT OF WORK (SOW)

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD:

☐ **NRMRL=s Quality System Specifications:**

(1) a description of the organization=s Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization=s general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

☐ **NRMRL=s Quality System Specifications:**

(1) a description of the organization=s Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization=s general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

☐ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X **QAPP Requirements for Measurement Projects**

☐ **QAPP Requirements for Secondary Data Projects**

☐ **QAPP Requirements for Research Model Development and Application Projects**

☐ **QAPP Requirements for Software Development Projects**

☐ **QAPP Requirements for Method Development Projects**

☐ **QAPP Requirements for Design, Construction, and Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA=s Quality System Website: http://www.epa.gov/quality/
EPA=s Requirements and Guidance Documents:
http://www.epa.gov/quality/qa_docs.html

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS: Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used.

Include procedures for homogenizing, compositing, or splitting of samples, as applicable.

4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.

4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.

4.5 Describe the method for uniquely numbering each sample.

4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5. MEASUREMENT PROCEDURES

5.1. Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.

5.2. If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6. QUALITY METRICS (QA/QC CHECKS)

6.1. For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

6.2. Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

7.2 Describe data validation procedures used to ensure the reporting of accurate project data.

7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).

7.3.1 If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

7.3.2 If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

7.4 Describe data storage requirements for both hard copy and electronic data.

8. REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.